THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXX. No. 1785.] LONDON, JULY 27, 1897. [49TH YEAR. PRICE 6d.

TUBES AND FITTINGS
FOR
GAS, STEAM, WATER,
AND ALL PURPOSES,
ALSO
COILS OF EVERY SIZE AND SHAPE.

Apply to the Original Firm of
JOHN BROTHERTON
LIMITED,
Imperial Tube Works, Monmore Green,
WOLVERHAMPTON.
ESTABLISHED 1861.

GAS CONSUMERS' REQUIREMENTS.
TUBES, COCKS, UNIONS, BRACKETS, PENDANTS, LANTERNS, CHANDELIERS, AND GENERAL FITTINGS.
MANUFACTURED BY
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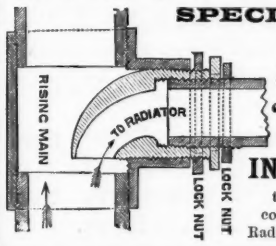
15, 16, 17, Kirby Street, London, E.C.



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FOR
HOT-WATER CIRCULATION.
'ACME' PATENT INJECTOR,
to be fixed in connection with Radiators on Mains.

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PARKER & LESTER,
Manufacturers & Contractors.
THE ONLY MAKERS
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores, for Gas and Water Works.
WORKS:
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'BEAR CREEK' CANNEL
LOG MOUNTAIN COAL, COKE, AND TIMBER CO.
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Communications to the Company only.

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"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
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HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

ECONOMY IN FUEL.

The CAMBRIDGE ELECTRIC SUPPLY CO., Ltd.,
Thompson's Lane, Cambridge,
May 5th, 1897.

Messrs. MELDRUM BROS., MANCHESTER.

YOUR FURNACES.

Dear Sirs,
At the end of the month's trial, April 30, you will be glad to hear that your furnace has fulfilled the guarantee: the amount per unit Generated in coal has been reduced by 17½ per cent., and per unit sold 30 per cent. The absence of smoke is very marked, excepting a slight amount when the boiler has been forced hard. We have on several occasions obtained an evaporation of over 8000 lbs. per hour (boiler being two-flue Lancs., 30 ft. by 7 ft. 6 in.). There is little doubt that the Board at their next meeting will decide to add these furnaces to the two remaining boilers. (Signed) *JOHN H. BARKER.*

NOTE.—Since the above letter was written, we have received the order for the two remaining boilers.

MORE STEAM.
LESS COST.
LESS SMOKE.

5000
WORKING.

Write for Catalogue and other Testimonials.

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Atlantic Works, MANCHESTER,
ALSO AT
London, Liverpool, Leeds, Birmingham, Glasgow, Newcastle-on-Tyne, Paris, New York, Bombay, Calcutta, Tokio, Sydney.

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(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

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WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

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ENGINEERS & CONTRACTORS FOR GAS-WORKS.

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THE IRON-WORKS, FROME.

PRICES ON APPLICATION TO THE SOLE MAKERS.

Messrs. COCKEY desire to draw the attention of Gas Engineers and Managers to their new form of GAS WASHER, which, by a recent patent, converts their HORIZONTAL Washer into one of a VERTICAL form.

The principle is the same as in the horizontal one, which has now been before the profession for a number of years, and where adopted is giving unqualified satisfaction.

The Washer is entirely automatic in its action, and does not therefore need any motive power—an advantage which will be apparent to all.

It is made in all sizes, from **25,000 TO 3,000,000** FEET PER DAY; and Messrs. COCKEY invite inquiries, which shall have early attention.

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WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

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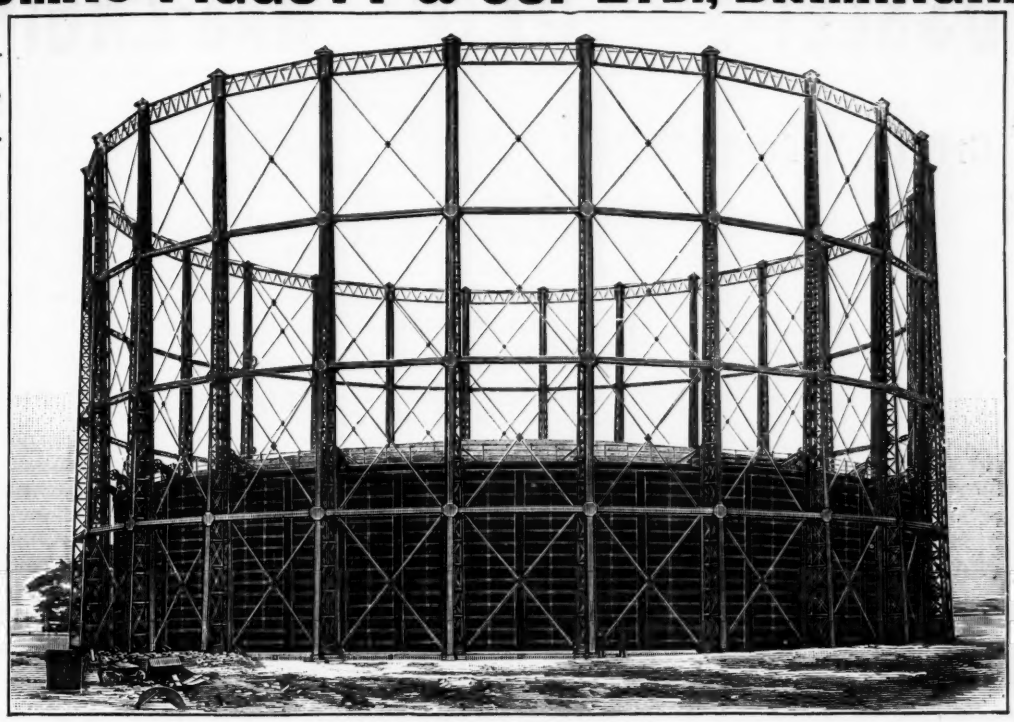

TELEGRAPHIC ADDRESS: ATLAS BIRMINGHAM

WELDED & RIVETED PIPES, FOUL MAINS, RETORT LIDS, WROT & CAST TANKS, PURIFIERS.

MANUFACTURERS OF

HUMPHREYS & GLASGOW'S

PATENT CARBURETTED WATER-GAS PLANT.

INSTALLATIONS HAVE ALREADY BEEN SUPPLIED, AND ARE IN HAND FOR THE FOLLOWING GAS-WORKS: COPENHAGEN, BELFAST, GLASGOW, BRUSSELS, SANTIAGO, SWANSEA, TOTTENHAM, LIVERPOOL, BRIGHTON, BATH, PRESTON, SOUTHPORT, NEW YORK, NEWBURGH (N.Y.), NEWBURGH (SECOND CONTRACT), HOYLAKE, BELFAST (SECOND CONTRACT), EDINBURGH, TOTTENHAM (SECOND CONTRACT), WINCHESTER, MANCHESTER, BRUSSELS (SECOND CONTRACT), ST. JOSEPH (MO.), HOLYOKE (MASS.), SHANGHAI, STOCKTON, STOCKPORT, NORWICH, GUILDFORD, SYRACUSE, BORDENTOWN, LEA BRIDGE, COVENTRY, COMMERCIAL, BRENTFORD, BRIDLINGTON, MIDDLESBROUGH, CROYDON, L. & N.W. RY. CREWE, NINE ELMS, BROMLEY, COVENTRY (SECOND CONTRACT), TAUNTON, ROTTERDAM, DORKING, LEA BRIDGE (SECOND CONTRACT).

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TRADE MARK.

NO TAPPETS.

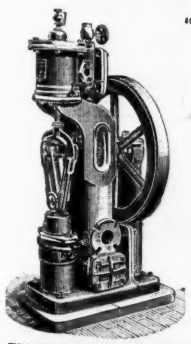


Fig. 705. "SINGLE RAM" STEAM-PUMP.

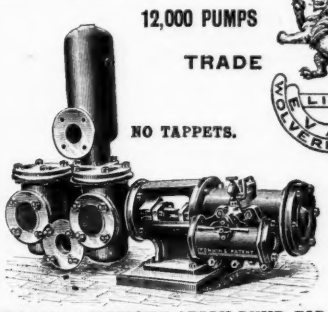


Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

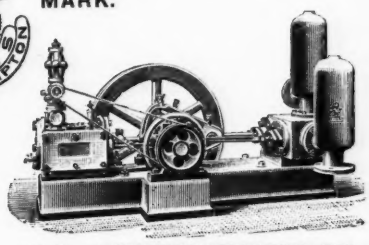
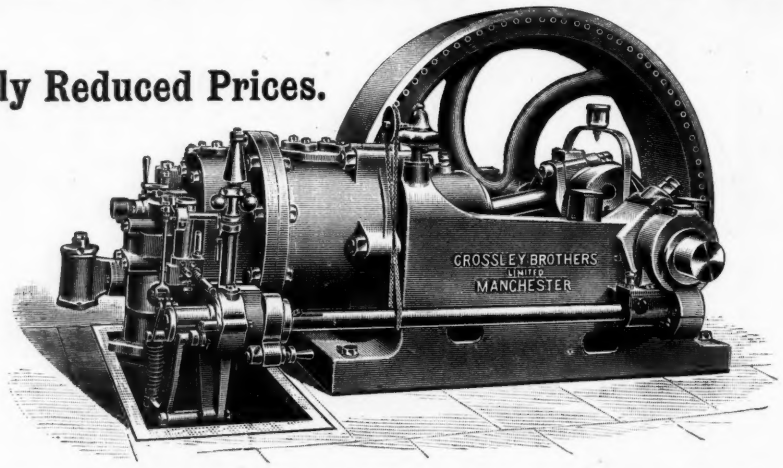


Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP

CROSSLEY'S "OTTO" GAS-ENGINES

Greatly Reduced Prices.



REPRESENTS NEW TYPE 40-HORSE POWER NOMINAL HIGH-SPEED ELECTRIC-LIGHT ENGINE.

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G. & J. HAIGH,

Raven's Lodge Fire-Brick Works, DEWSBURY.

FIRE-BRICKS of the highest Quality, made from Fire-Clay of a most Superior and Refractory Character, suitable for **GLASS-WORKS, GAS-WORKS, and BLAST-FURNACES.**

WHITE GLAZED AND SALT GLAZED BRICKS, BUFF FACING BRICKS, &c.

For Prices and Analysis, apply as above.

NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

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WITH RACK & PINION
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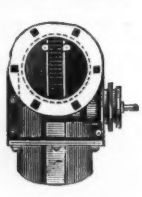
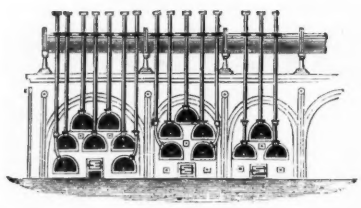
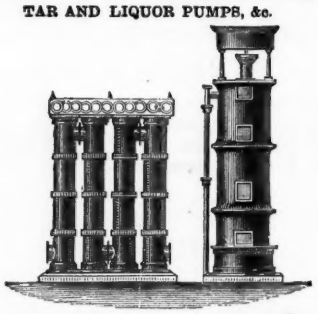
SCREWS of all sizes.
GASHOLDERS,
AND
Gasholder Tanks.



CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description,
Iron Roofs, Columns, Girders, Floor Plates
Tools, &c.



WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.



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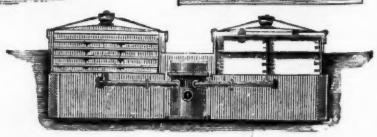
for working Purifiers,
Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS, and SPECIALS.
WOOD GRIDS.
CAST AND WROUGHT IRON TANKS AND CISTERNS.



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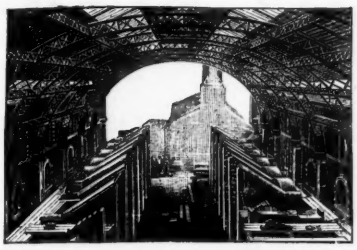
Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

W. C. HOLMES & CO.

IRONFOUNDERS AND CONTRACTORS.

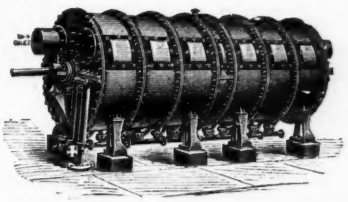


Makers of
GAS & CHEMICAL
PLANT.

Telegrams:
"HOLMES, HUDDERSFIELD."

Improved
PATENT SCRUBBER-WASHERS,
All sizes,
From 50,000 to 5,000,000 Cubic Feet of Gas per day.
Results unrivalled. Send for Particulars and Prices.

MALLEABLE
and all Kinds of
CASTINGS.



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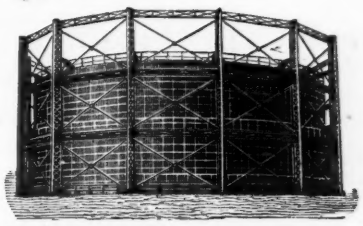
ROOFS, BRIDGES, TANKS, GIRDERS.



Improved
BYE-PASS and
CENTRE-VALVES,
GOVERNORS,
and METERS.

Rotary or Pump
EXHAUSTERS.

80, CANNON STREET, LONDON,
AND
WHITESTONE IRON WORKS, HUDDERSFIELD.

THE
MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

Over 50 Maxim Patent Carburettors have now been fixed, capable of enriching

650,000,000

CUBIC FEET OF GAS PER DAY.

Among the Companies supplied are The Gaslight and Coke Company, the South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **FOUR YEARS.**

More Gas and saleable Coke per ton of Coal Carbonized is produced; saving Capital Labour, Fuel, Wear and Tear, &c.

The Enrichment is **INSTANTANEOUS** and **PERMANENT.**

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas for the Enrichment of Gas.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

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INCANDESCENT GAS-LIGHT

(WELSBACH PATENTS).

THE GREATLY REDUCED CONSUMPTION OF GAS

Covers the Initial Cost of the Burner in less than SIX Months.

The Prices have been REDUCED as follows :—

The Ordinary "C" Burner, price 6/6

The "C" Bye-Pass Burner, „ 7/6

Prices of other Patterns Reduced Proportionately.

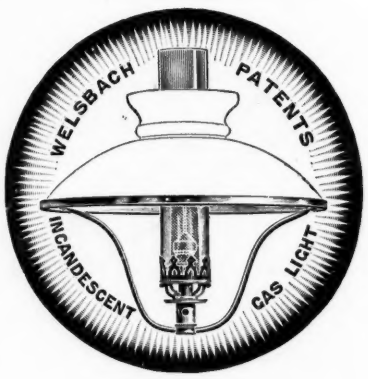
Special attention is called to

The New "Gem" Burner, price 5/6

which, with a consumption of 1¾ cubic feet of gas an hour, gives

A LIGHT OF 30 TO 35 CANDLE POWER.

This pattern is particularly suited for Domestic Lighting, and is specially recommended where it is desired to effect a large saving in gas rather than to effect a great increase in the light.



The attention of **Gas Managers and Gas Engineers** is called to this System of Lighting as one which tends to **Popularize the Use of Gas** as an Illuminant, owing to the following Advantages :—

Economy in Consumption of Gas, combined with High Illuminating Efficiency.

Freedom from Smoke, Dirt, and Flickering.

Greatly Reduced Heat.

The combination of High Lighting Power with DURABILITY can only be obtained by The Welsbach System.

The **"Lancet" Special Analytical and Sanitary Commission,** in an exhaustive report, pronounces the "Incandescent Gas-Light System" to be the **Healthiest, Best, and most Economical System of Gas Lighting.**

Suitable for every purpose of **Inside and Outside Lighting.**

Avoid the WORTHLESS IMITATIONS now being offered by UNSCRUPULOUS INFRINGERS.

OVER ONE HUNDRED AND FIFTY JUDGMENTS

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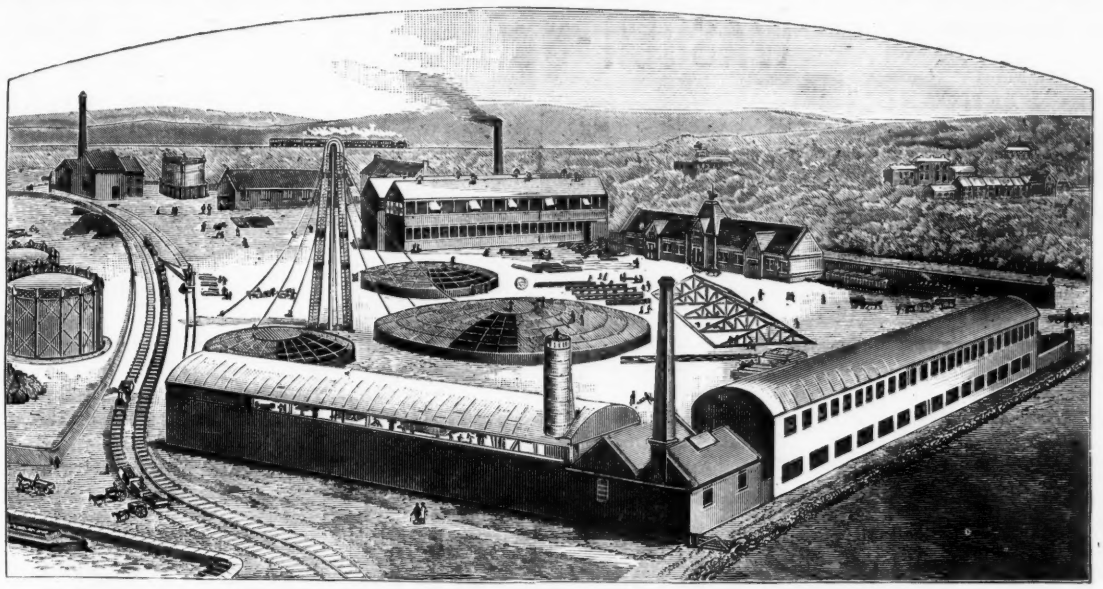
WILLEY & CO., GAS ENGINEERS.

OFFICES: EXETER. WORKS: 248, Kingsland Road, LONDON; James St., and St. Thomas, EXETER.



MANUFACTURERS OF WATER-GAS PLANT, GASHOLDERS, GAS-FITTINGS, GAS APPARATUS, WET AND DRY CONSUMERS' METERS, AUTOMATIC METERS—PENNY-IN-THE-SLOT.

CONTRACTORS TO THE GOVERNMENT.

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CARBURETTED WATER-GAS PLANT.

(CUTLER'S PATENTS)

ADOPTED AT HORNSEY, HASTINGS, SOUTHEND, PLYMOUTH, BUENOS AYRES, SOUTHALL (BRENTFORD GAS COMPANY).

GASHOLDERS

OF EVERY SIZE AND DESCRIPTION.

CUTLER'S PATENT GUIDE-FRAMING FOR GASHOLDERS

HAS BEEN ADOPTED FOR MANY IMPORTANT HOLDERS.

IT IS STRONG AND CHEAP, AND REQUIRES NO PIERS FOR ITS SUPPORT.

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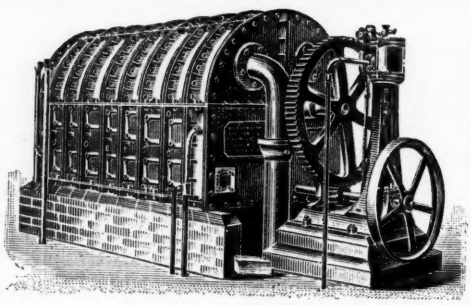
PATENT "STANDARD" WASHER-SCRUBBER.

This Apparatus upholds its title, the "STANDARD;" being recognized by leading Engineers as the most efficient Apparatus for the Extraction of Ammonia from Coal or other Gases.



The Largest Order ever given for WASHER-SCRUBBERS was recently received being for **16** Patent "Standard' Washer-Scrubbers, each for 3,500,000 Cubic Feet of Gas per day.

Number of Patent "STANDARD" Washer-Scrubbers in use at this date

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THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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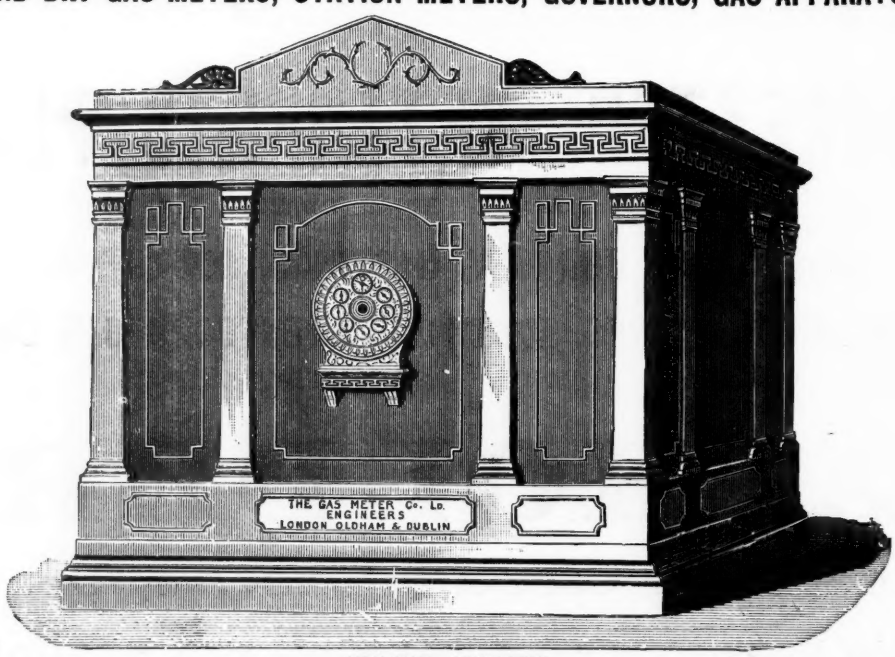
THE GAS-METER COMPANY, LIMITED

MANUFACTURERS OF

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.



STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, Late WEST & GREGSON. Established 1830.

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Telegraphic Address: "METER."

(See Advertisement on back of Wrapper.

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SINCE 1893

MESSRS. HUMPHREYS & GLASGOW

Have constructed or have in hand

CARBURETTED WATER-GAS PLANT

FOR THE FOLLOWING UNDERTAKINGS:—

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Copenhagen	700,000	Norwich	1,000,000
Belfast	1,700,000	Winchester	200,000
Belfast (Second Contract)	4,500,000	Holyoke, Mass.	600,000
Glasgow	300,000	Hoylake	125,000
Brussels	700,000	Shanghai	225,000
Brussels (Second Contract)	700,000	Stockport	500,000
Liverpool	3,500,000	St. Joseph, Mo.	750,000
Tottenham	750,000	Lea Bridge	350,000
Tottenham (Second Contract)	750,000	Lea Bridge (Second Contract)	350,000
Santiago	400,000	Guildford	350,000
Swansea	750,000	Stockton-on-Tees	500,000
Manchester	3,000,000	Syracuse, N.Y.	850,000
Brighton	1,750,000	Brentford	1,200,000
Preston	1,500,000	Commercial Gas Co.	850,000
New York	1,200,000	Commercial Gas Co. (Second Contract)	850,000
Southport	750,000	Bridlington	125,000
Bath	1,000,000	Middlesbrough	1,250,000
Newburgh, N.Y.	350,000	Croydon	1,250,000
Newburgh, N.Y. (Second Contract)	250,000	L. & N.W. Railway, Crewe	700,000
Edinburgh	2,000,000	Taunton	225,000
Coventry	600,000	Rotterdam	850,000
Coventry (Second Contract)	600,000	Dorking	125,000
Bordentown, N.J.	125,000		

THE GASLIGHT AND COKE CO. { Nine Elms / Bromley } . . . . . 6,250,000 Cubic Feet.

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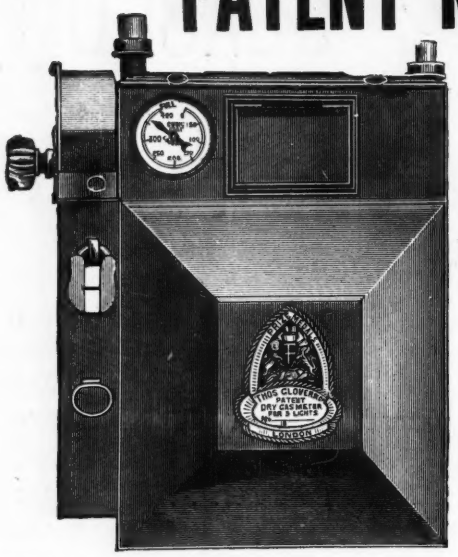

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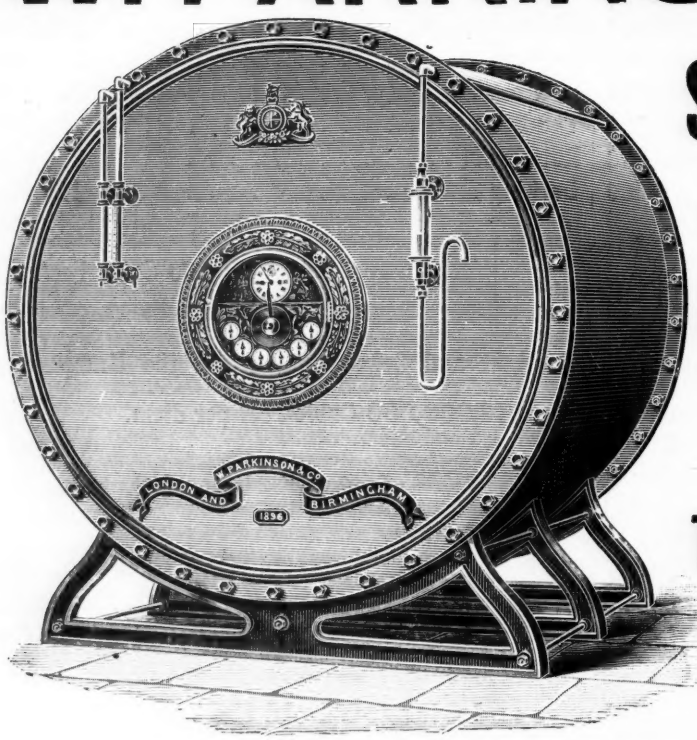

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CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
Further Incandescent Gas-Light Litigation—The Judgment in the Rawson Suit . . . 207
Abandonment of the Inclined Retort Patent Appeal . . . 208
Workmen's Compensation in the Lords . . . 208
Progress of the Engineering Trade Dispute . . . 208
The Purification of the Atmosphere of London . . . 209
WATER AND SANITARY AFFAIRS—
The Metropolitan Water Companies Bill in Committee . . . 209
The London County Council and the Water Question . . . 209
Meeting of the British Association of Water-Works Engineers . 210
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 211
Electric Lighting Memoranda . . . 211
The Design of Electric Light and Gas Fittings . . . 212
COMMUNICATED ARTICLE:—
Sodium Ferrocyanide. By H. F. Fermor . . . 213
TECHNICAL RECORD:—
British Association of Water-Works Engineers—Annual Meeting—The Formation of Water Boards . . . 213
Inaugural Address by Mr. H. Ashton Hill . . . 214
Société Technique du Gaz en France—The Papers Read at the Annual Meeting . . . 216
REGISTER OF PATENTS:—
Regenerative Furnaces for Heating Gas-Retorts—Helps, G. . . . 217
Controlling Valves for Gas-Burners—Boardman, F. R. . . . 218
Supporting the Mantles for Incandescent Gas-Burners—Symons, P. 218
Generating Acetylene Gas—Reynolds, D. J. . . . 218
Prepayment Attachments for Meters—The California Prepayment Meter Company and H. W. Williams . . . 219
Burners for Incandescence Gas Lighting—Léry, J. B. de . . . 219
Acetylene Gas Burner—Lebeau, J. . . . 219
Patent Notices . . . 219
CORRESPONDENCE:—
The Accident Fund of the South Metropolitan Gas Company . . 220
The Price of Gas Coke . . . 220
PARLIAMENTARY INTELLIGENCE:—
House of Lords—Progress of Bills . . . 220
House of Commons—Trade Unionism and British Trade; Metropolitan Water Companies Bill; Deficient Water Supply in Bermondsey; Progress of Bills . . . 220
LEGAL INTELLIGENCE:—
High Court of Justice—Queen's Bench Division—The Sunlight Incandescent Gas-Lamp Company, Limited, *v.* The Incandescent Gas-Light Company, Limited . . . 221
A Bankrupt's Gas Bill . . . 228
The Law Relating to Water Supply in the United States . . . 228
Carpenter *v.* Commercial Gas Company . . . 228
The Richmond Gas-Meter Case . . . 228
MISCELLANEOUS:—
Meeting of the European Gas Company, Limited . . . 229
Ayr and Newton-on-Ayr Gas Supply—The Rise and Progress of the Gas Companies . . . 229
Accident at the Bury Gas-Works—A Man Suffocated in a Tar-Still 230
Birmingham Corporation Gas Supply—Wages and Labour at the Works; Mr. Hack's Salary . . . 230
Nottingham Corporation Gas Supply—Annual Reports . . . 231
Electric Lighting Notes . . . 231
The London County Council and the Water Question—The Past Year's Work; The Council and the Water Commission . . . 232
Liverpool Corporation Water-Works . . . 232
Water-Works in Japan . . . 232
Notes from Scotland . . . 233
Current Sales of Gas Products—Coal Trade Reports . . . 233
Gas and Water Companies' Stock and Share List . . . 234
PARAGRAPHS:—
PERSONAL: Mr. Boverton Redwood . . . 210
OBITUARY: Vitruvius Wyatt . . . 210
Amalgamation of Gas Meter and Stove Manufacturers . . . 209
Adoption of the Denayrouze System in the Bournemouth Arcade. 210
The Storage of Carbide of Calcium . . . 211
The Reconstruction of a Gasholder at the Old Kent Road Gas-Works . . . 212
Carbide of Calcium as an Insecticide . . . 213
Mixtures Containing Ethane—Gas-Engines for Electric Lighting. 216
The "London Manual"—Our Coal Resources—Hanssen on the "Reform of Chemical and Physical Calculations" . . . 217
Inauguration of the Loanda Gas-Works—Goole Gas and Water Supply—Automatic Gas-Meters in Montreal . . . 219
Fatality at the Higginshaw Gas-Works, Oldham . . . 231
Deal Water Company—The Testing of Gas and Meters by the London County Council . . . 232
Cromer Water-Works Company, Limited—Reduction in Price—Tottenham Water Supply—The Wessenden Water-Works of the Huddersfield Corporation—Seville Water-Works Company, Limited . . . 234
Windsor Water Supply—New Joint-Stock Companies—The Proposed New Gas-Works at Padiham—Blackburn Corporation Gas and Water Finances—Automatic Gas-Meter (1895) Corporation—The Price of Gas in the Salford Out-Districts—The New Staines Reservoirs Stock—Hoylake and West Kirby Gas and Water Company, Limited . . . 235
Sales of Shares—Llandudno Gas and Water Supply—Colne Valley Water Company—The Purchase of the Chichester Water-Works by the Corporation . . . 236

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EDITORIAL NOTES.

Further Incandescent Gas-Light Litigation—The Judgment in the Rawson Suit.

ANOTHER of the heavy incandescent gas-light patent law-suits was disposed of last week by Mr. Justice Wills, who about a year ago gave the De Mare system its *quietus*. This time it was a question as to the validity of a patent taken out by members of the once prominent firm of Woodhouse and Rawson for a process whereby the fragile Auer von Welsbach mantles could be so toughened after incineration as to bear transportation by the ordinary channels, and a reasonable amount of handling. The evidence in the case, which will be found reported elsewhere, is very interesting. The Incandescent Gas-Light Company were defendants in the action, which was brought against the Company, and also against the Directors individually, by the Sunlight Incandescent Gas-Lamp Company, who had acquired the Rawson patent. The history of the Rawson invention is soon told. At the time when the founder of the Welsbach Companies in England and many other countries outside Austria—Mr. Frederick Williams—first foregathered with Dr. Auer, the latter had just succeeded in experimentally perfecting the new system of gas lighting; that is to say, he had availed himself of the fact of the high incandescing quality of the "rare earths," and had produced the type of burner best suited for developing this property for the ordinary purposes of lighting. Here, for the moment, Dr. Auer rested. His local licensees for Vienna were carrying on a business in distributing incandescent gas-lamps throughout the city; the mantles being sent away already fixed upon the galleries, and enclosed in their chimneys. The mantles were so fragile that they could not be treated otherwise; and when a mantle broke or became worn out, the local practice was to take the complete fitting back to the warehouse and get another in place of it. Mr. Williams, like many others who in those early days took an interest in the new system, perceived that, while this style of doing business might answer for the time being in Vienna, something more practical would have to be devised if the Welsbach mantles were ever to become articles of universal commerce. Consequently, he urged Dr. Auer to use something to render his mantles more portable, in the commercial sense. But the great chemist had other cares. The properties of the incandescing substances had to be explored to the uttermost; and this was a research to which he addressed himself with all the ardour and devotion of an adept. He showed his commercial colleague, Mr. Williams, how in principle the mantles could be toughened by dipping in dissolved shellac, and declared that the finding of a suitable preparation for the purpose was a matter of experiment which any expert chemist should be competent to deal with. In this, as the event proved, the eminent expert was slightly mistaken. To do what was required was the work of nearly two years' constant experimenting by many hands.

While this point was unsettled, Mr. Williams, in his capacity of Managing-Director of the first English Welsbach Syndicate, employed the Woodhouse and Rawson Company—then in the full swing of their brief industrial and mercantile career—to perfect the burner for the English market. There was a conflict of testimony with regard to the amount and quality of the work done by the Company under the terms of their agreement with the Welsbach Syndicate; but it is at least certain that, during their connection with the Syndicate, the Rawsons took out a patent for toughening Welsbach mantles by dipping them into melted paraffin. It was this patent that was brought into question in the action. The plaintiffs claimed that it covered all methods of toughening mantles by any material that sets, and answers the purpose. Defendants objected that they actually toughen their mantles by the use of a preparation of which the basis is collodion, and that this material does not "set" in the same sense that the word bears when applied to the setting of paraffin wax. Moreover, it was objected that the Rawson patent—which has expired—was void on the grounds of inutility and anticipation, notably by Clamond, who stiffened the magnesia baskets of his incandescent burners of 1882 by dipping them into dextrine.

In the event, the Judge construed the Rawson patent as

being limited to the employment, with the object mentioned, of paraffin or some analogous substance which sets by cooling at ordinary temperatures. This construction excludes all such substances as collodion, which does not set, but solidifies by the evaporation of the constituent which keeps it fluid in closed vessels at ordinary temperatures. This limitation of the patent therefore gave the judgment to the defendants, the Incandescent Gas-Light Company, on the score of infringement; and the general costs of the action followed the judgment. It was held, however, that plaintiffs had succeeded on the other counts —that is to say, that the Rawson patent was a perfectly good one, inasmuch as it had not been effectively anticipated; that the patentees were the true and original inventors; and that the invention possessed utility, albeit not of the commercial kind. Consequently, they are to have the costs of trying these issues. There is a curious point of law in the last-named order which we must refrain from discussing. Indeed, it is not possible to say anything about the merits of the judgment, as it will probably be appealed. We can only congratulate the victors—whoever they may ultimately prove to be.

Abandonment of the Inclined Retort Patent Appeal.

THE appeal of the Salford Corporation against Mr. Justice Romer's judgment in the matter of the Coze inclined retort patent has been abandoned; and the Automatic Coal-Gas Retort Company have come to terms with the Corporation upon the basis of the full recognition of their rights in the system. This is good news, not only for the Company and the Corporation, but also for everybody interested in the progress of mechanical inventions. We have always admitted that the Coze system, in its original dress, was certain to be submitted to much modification by way of adapting it to the requirements of English gas-works; but it has never been seriously disputed that the key to ultimate success in the charging and discharging of gas-retorts by gravitation was given to the technical world by this meritorious inventor. It was not difficult to understand the view of the Coze patent taken by the Salford Corporation before the question raised at their instance had been submitted to the arbitrament of Mr. Justice Romer. It is always hard to say where the line should be drawn between consequential improvement and new invention; but it was pretty clear that when the Salford Corporation took to the inclined retort system they found more in it than they brought. The Company are wise in meeting the Corporation, as we understand they have done, in the most liberal spirit consistent with the maintenance of their legal rights; and now it is to be hoped that this system of carbonizing will go forward without further interruption to the realization of the great future which its friends believe to be awaiting it. There has been a good deal of prejudice, as well as interested opposition, to the extension of the system under the old conditions. These have now been changed, and practical carbonizers must be relieved to know that whatever extraneous circumstances may have hitherto existed to hinder the system from taking the place proper to its merits, are in a fair way of being removed. We should be loth to believe that English gas undertakings as a class will seek to deny to the inventor and the proprietors of the Coze system the credit or the reasonable recompense due to their ingenuity and enterprise. Sceptics have observed that the Gas Companies and Gas Committees of Corporations of the United Kingdom are waiting for the master-patent to run out before taking up with the system extensively. This unworthy attitude, however, if it has its attractions, is not unlikely to foster within itself the germ of a great disappointment.

Workmen's Compensation in the Lords.

THIS day week, the Workmen's Compensation Bill was read a second time in the House of Lords. Beyond the bare statement of fact, there is little to be said here respecting this stage of the measure. The Earl of Wemyss, on behalf of the Liberty and Property Defence League, had previously taken one of those false steps which cause the adversaries of this particular expression of individualistic sentiment to scoff, by formulating a purposeless denunciation of the Bill in the columns of the daily newspapers. Anyone reading this apparently formidable indictment of the measure, set out as it was with considerable pomp of logical criticism, would naturally expect that the Minister in charge of the Bill would have a bad quarter of an hour when he came to face the strenuous champion of Liberty and Property in the gilded chamber. But those who knew better the ways of the noble Lord were not afraid of anything serious happening. Lord Wemyss ran away from his protest—rumour has it, because the bulk of his clients outside the House warned him that he was proposing to take up an untenable position. It is greatly to be regretted that by this empty proceeding Lord Wemyss has seriously damaged the prestige of the special organization with which he is so closely identified. Lord Londonderry stood to his guns alone, and solemnly warned the House that the great coal industry of the country cannot bear the burden of the 2d. per ton which would be sufficient to insure every workman employed in it against the risks of his occupation. The country and the Houses of Parliament have heard this assertion before, and have refused to credit it. In winding up the debate, the Prime Minister poured contempt upon the statement, and asked Lord Londonderry a pointed question about the extent to which the coal industry had been relieved by the abolition of the London Coal Dues. This was a highly effective contribution to the debate. But such a query does not exhaust this aspect of the burdens of the coal industry, as Lord Salisbury very well knows. We can tell where a good part of the old London Coal Dues have gone. They went, in the first place, to cheapen London gas; but it was not long before they found their apparently permanent equivalent in the reduced value of London coke. In one respect, the Gas Companies have suffered from this reduction; but in the last place the consumer of fuel benefits. Upon the merits of the Bill, Lord Salisbury was very impressive. After all that has been said and written respecting the principle and applications of the Bill, it might have been deemed hardly possible for anybody to say anything very fresh or interesting on the subject. But the Prime Minister of Great Britain is no ordinary man; and his speech of last Tuesday was worthy of his great reputation and of the occasion.

Progress of the Engineering Trade Dispute.

THERE is little to be recorded this week concerning the dispute in the engineering trade, beyond the official report that down to Saturday evening 38,000 men of the allied trades were "out" in different parts of the country. The Executive Council of the Amalgamated Society of Engineers have put forth another manifesto, in which, after endeavouring to fix upon the employers the responsibility for having precipitated the conflict with "almost criminal "recklessness," the strike leaders engagingly proceed to describe their opponents as "men swollen with the pride of pelf, "blinded by prejudice, and insensible to the finer feelings of "humanity." It will appear to most observers that this is not a very hopeful way of conducting the discussion of an economic question, while the style of rhetoric plainly indicates the character of the influences that actually dominate the Trade Union Councils. Of a piece with this is the hectoring communication addressed by Mr. George Barnes, the General Secretary of the A.S.E., to the Admiralty, boldly declaring that the Executive Council of this high and mighty Society "could not sanction" the employment of Government engineers to facilitate the trial trips of two battleships now on the point of completion by contract. A touch of the ludicrous is imparted to the situation by the issue of an appeal by the Independent Labour Party for contributions in aid of the present effort to obtain the eight-hour day. The success of the movement is declared to imply "distinct progress "towards Socialism." The humour of this statement lies in the circumstance that the aim of the strike is explicitly limited to obtain the eight-hour day, with nine hours' pay, for the London trade alone. The Clyde men have distinctly disclaimed all desire to participate in the boon, which is not in question at any other centre of the engineering trade out of London. This consideration lends still greater force to our remarks of last week upon the blundering tactics of the strike leaders in accepting the principle of local differences of the length of the working day and rates of wages for the same kind of work in different parts of the same country. Assuming, for the sake of argument, that it would be a good thing for the working classes if London were to become socialistic, according to the ideas of the term entertained by the Independent Labour Party, why should the Provinces

remain out in the cold? Merely to ask the question is enough to show the hollowness of the socialistic pretensions that are put forward in connection with the present movement. Whatever else it may be, the strike is not socialistic, unless the monstrous conclusion be accepted that Socialism can be districted.

The Purification of the Atmosphere of London.

BEFORE all is said about the marvellous events and incidents of this record summer, there is to be mentioned one fact of tremendous importance which those who have eyes to see what is going on around them must have perceived, but which, so far as we have read contemporary literature, has nowhere been mentioned. It is that of the increasing purity of the atmosphere of London, which is mainly to be attributed to the extensive use of gas-stoves, particularly by the poorer classes, whose smoky chimneys have in the past contributed so powerfully to the murkiness of London air. When one comes to think of it, where in all the world besides, at any epoch, have four or five millions of people, with their horses and chariots, their meat and drink, come together so closely with such small mutual offence? The purification of the River Thames has proceeded until that noble stream where it passes through London is much cleaner now than it has been these hundreds of years. When the Prince of Wales the other day opened the new Gallery of British Art, which, thanks to the munificence of Mr. Tate, occupies part of the site of the old Millbank Penitentiary, somebody seized upon the opportunity of reminding the British public that London is yet a long way behind the Athens of Pericles as regards the magnificence of its public buildings. That is true; for among all the glorious gains of the nineteenth century a living school of true and in all respects acceptable architecture cannot be counted. But London is better drained than Athens was; and water, fuel, and light are brought into the dwellings of the modern Londoner after a fashion that the men of Athens knew not. For the present, however, we are specially concerned to point out that all this summer there has been no such thickness of the London atmosphere as citizens now living once regarded as inevitable. The change has been most marked all along the numerous railways that enter London at a high level. Where, only a year or two ago, the morning breakfast fires filled the air with their pungent reek, there have not been more than a very few chimneys testifying to the old-fashioned character of the household. Whole streets—practically complete quarters of the most densely populated parts of the Metropolis—have become to all intents and purposes smokeless for the summer season. This has been brought about not by means directly aimed at the result, but incidentally as a consequence of the increasing popularity of gas. Electricians and their less thoughtful partisans among the professional sanitarians, pretend that what they are fond of regarding as the decadence of the gas industry will make for improved sanitation. But is there anything in this line more to be desired than the disestablishment of the domestic coal-fire? And can anything effect this object so quickly and advantageously to the community as the gas-stove? How far the movement has already progressed in London has been made manifest this year. Happily it is a movement that may be trusted to gather momentum as it goes; so that some day the tradition of the smokiness of the London atmosphere may become a mere superstition.

Amalgamation of Gas Meter and Stove Manufacturers.—An amalgamation has been effected between the old-established firm of Messrs. Thomas Glover and Co., Limited, Gas-Meter Makers, of Clerkenwell, E.C., and Messrs. R. & A. Main, Gas-Stove Manufacturers, of Glasgow and London. To all outward appearance, however, there will be no change, as the two businesses will continue to be carried on separately, under the styles of Thomas Glover and Co., Limited, and R. & A. Main, Limited; while, solely for the purposes of the amalgamation, a third Company has been registered under the title of Glover and Main, Limited. The capital of the joint concern is £250,000, divided into 200,000 ordinary and 50,000 preference shares; but no shares of either class are to be offered to the public. With regard to the direction of the new Company, Messrs. Richard T. and John G. Glover will act as Managing-Directors of the business with which they have been so long identified; and Messrs. Robert and Archibald Main will occupy similar positions in connection with their division of the concern. Messrs. Paul A. Makins and Kenneth Aird are members of the Board.

WATER AND SANITARY AFFAIRS.

THE House of Commons, when dealing with the Government Water Bill in Committee last week, found no difficulty in passing the very important third clause, by which the Metropolis Water Acts of 1852 and 1871 are extended to the whole of the area within which the Companies are authorized to supply water. On the clause which provided that the Act should come into operation on the 1st of November, an amendment was brought forward by Mr. Buxton, limiting the operation of the Act to Nov. 1, 1899. How the third clause could be worked under such restriction it is hard to comprehend. Mr. Chaplin himself was utterly at a loss to understand why they should tie their hands by accepting such a proposal. After some discussion, the amendment was lost by a large majority. Then followed one still more impracticable, moved by Mr. Holland, providing for a deduction from the water-rate in the case of a deficiency in the supply. There was a long discussion over this absurd proposal, in the course of which Mr. Chaplin incidentally mentioned, in reply to a remark made by Mr. Holland, that "the Government had never "pledged themselves to a policy of purchase." In the end, the Bill passed through Committee, having undergone no change of any consequence. We observe an admission from Mr. James Stuart, that "the New River Company "satisfactorily fulfilled their obligations." This acknowledgment covers about 18 per cent. of the water supply of London.

Last week's debate in the County Council on the subject of the water supply brought out some points of interest, though the discussion was once more adjourned. It was resolved, after rejecting an amendment proposing control, that the water supply of the Metropolis ought not to continue in the hands of private Companies. So much for the continuance; but it should be remembered that the commencement was not due to the public authorities. London owes its water supply to private enterprise; and the undertakings having become profitable, a public authority would like to take the place of the Companies. As for cost, Mr. Dickinson, the Chairman of the Water Committee, thinks that £40,000,000 for the Companies is an extravagant estimate. Thus there is a limit drawn to what the Progressives call the "fair and reasonable value" of the undertakings. The price to be paid is something less than £40,000,000, but how much less is not declared. Mr. Westacott put the full value at £36,000,000; and he asked whether the Council would pay this amount, or "punish the Water Companies." Mr. Dickinson appears to have said that the consumers were now paying £160,000 a year more than they would have to pay if the Companies had been bought up in 1871. But how was it that the undertakings were not purchased? The opponents of the Conservative Government were furious at the price proposed; and the terms which had been framed under the auspices of Mr. Cross were impetuously thrown overboard. As the case now stands, Mr. Westacott tells the Council that, if they pay the full value of the water undertakings, there will be an additional rate of 4d. in the pound. Mr. Porter, who tried in vain to carry an amendment setting forth that the Council should not pronounce an opinion in favour of purchase pending the inquiry by the Royal Commissioners, argued that if the Council were going to purchase, they should know what the cost would be. This is just one of the points the Commissioners are going to investigate, and on which the Council have been asked to give evidence. Will the Council show their hand, and make some public statement, in precise terms, as to "the financial aspect of purchase by a public authority?" Perhaps it will be found, as Mr. Westacott intimates, that the Council must either mulct the Water Companies, or add 4d. in the pound to the rates. It will be well if the Royal Commissioners can drag this into the light. It is virtually the same thing that was said some few years ago by a leading Progressive.

The annual address to the Council delivered by the Chairman (Dr. Collins) last week, dealt concisely with the work of the various departments during the past year, and has been generally commended. But the Welsh water scheme made its appearance; and it was argued that the Council could not be accused of undue precipitation in applying to Parliament for the necessary powers to carry out Sir Alexander Binnie's plan. Progress to this end, Dr. Collins said, will now be accelerated in view

of the admission "on all sides" that any further delay "may be perilous to the health and interest of the Metropolis." Yet Dr. Collins cites a calculation made by the Medical Officer at his request, showing the great decline which is taking place in the mortality of London. As for the admission "on all sides" that the present sources of supply must be either wholly or partially superseded, such unanimity is not to be found even at Spring Gardens. With respect to the purity of the water, we are glad to find Mr. M'Dougall making a complete explanation of his remarks, presented a week earlier, concerning the state of the Thames in the neighbourhood of Goring. The dreadful picture as to the "dirty brown colour" of the polluted water, resembling liquid manure from a farmyard, all "thick with suspended matter," now resolves itself into something like that which affects Loch Katrine. There is no sewage in the water, nor mineral contamination—the discoloration being simply caused by certain water plants; and the whole is destined to disappear before the stream reaches the intakes of the Water Companies. Thus vanishes "one of the worst pollutions "of the river observed for many years past."

As will be seen by the report which appears elsewhere, the second annual meeting of the British Association of Water-Works Engineers has been held. Numerically the organization continues to grow in strength; but it must be confessed that there does not seem to be that fervency among the bulk of the members which one looks for in a youthful society of this kind. Including associates, there is now a membership of, roundly, 160; but at no part of the business portion of the proceedings last week did the attendance reach more than a fourth of that figure. Seeing that the meeting was held in London, it is difficult to assign a reason for this heedlessness on the part of the general body of members. It is not in any captious spirit that we call attention to this matter, but in the hope that it may have the effect of stirring up the neglectful ones to a recognition of the duty which their membership demands, of encouraging and supporting their leaders by—in addition to the mere payment of a subscription—their presence at, even if they do not take any particularly active part in, the annual meetings. As must be evident to all of them, a great deal of labour and expense is involved in making the arrangements for such gatherings; and in the preparations for that of last week, nothing had been left undone on the part of the Council or their assiduous Secretary (Mr. W. H. Brothers) to ensure, by the help of the members, absolute success. Consequently—though not openly indicated—it must have been disheartening to those upon whom the labour fell to find that it was but ill-requited. The good start made at Nottingham ought certainly to be maintained.

The President for the year is Mr. H. Ashton Hill, who, since his removal from Wallasey to take the engineership of the most extensive (in area) of Provincial water undertakings—that of the South Staffordshire Water Company—has been lost sight of in the gas world; and it is a pleasure to see him reappear in a principal part in the work of an Association in which the "JOURNAL" is interested. Though, so far as our recollection goes, Mr. Hill never occupied a very prominent official position in connection with The Gas Institute, he contributed to the meeting in 1894 a useful paper giving the results of his experience in the use of cannel as an enricher at Wallasey. His address to the water engineers last week was just such a composition as one would expect from his pen. He did not aspire to any great literary excellence; but, in a plain and engaging manner, he reviewed the work of the Association during the past year, made an interesting statement concerning the South Staffordshire Water Company, and gave clear expression to his views on several matters—both engineering and legal—relating to the water profession. Previous to the delivery of the address, a subject claimed attention of which it is probable more will be heard in the future—that was, the question of the formation of Water Boards. The ex-President (Mr. D. M. F. Gaskin) moved the re-appointment of the Committee deputed last year to watch any movement which may be made in this direction. The protracted and abortive parliamentary fight between the Nottingham and Newark Corporations this session has intensified Mr. Gaskin's feeling that Water Boards, constituted of specialists, should be created for the purpose of investigating such measures—and quite naturally, seeing that, as the Water Engineer of Nottingham, a good proportion of the hardest of the preparatory work connected with the contest fell upon his shoulders. The motion was supported by that eminent geologist, Mr. W. Whitaker, whose experience will command respect for his views on this matter. The Committee were re-elected; and Mr. Whitaker consented to join them in their labours. The papers submitted to the meeting were varied in character; and some of them were prolific in discussable points. But the authors of one or two of the compositions fell into the error of burdening them with too much detail, which made them somewhat tedious. On the whole, however, the programme was an excellent one, and was worthy of a meeting of far larger dimensions.

PERSONAL.

Mr. BOVERTON REDWOOD, a member of the British Commission of the Brussels Exhibition, has been elected President of the International Jury dealing with the exhibits of appliances and materials for lighting at the exhibition.

OBITUARY.

VITRUVIUS WYATT.

ONLY a few days ago we had to record the removal by death of one who took a very prominent part in the administration of the affairs of The Gaslight and Coke Company. To-day we have to announce the decease of a gentleman who for a time held almost as important a position in connection with the engineering work of the Company. We refer to Mr. Vitruvius Wyatt, who died suddenly at his residence at Kilburn, in his 73rd year, on the 16th inst. Mr. Wyatt became an officer of the Company about thirty years ago—just at the time the undertaking started, so to speak, upon a fresh career, armed with the powers conferred by their new Act. The Company's Engineer in those days was Mr. F. J. Evans; and upon him devolved the planning and carrying out of the first portion of the great works at Beckton. In this he was assisted by Mr. Wyatt; and when, a few years later, Mr. Evans retired from the Company's service, his junior was appointed Constructing Engineer. This position he held for nearly ten years, during which time he carried out the second section of the works. On relinquishing his active duties, however, he did not cease to take an interest in the important branch of the engineering profession in which he had previously been engaged. He was Consulting Engineer to the Newcastle and Gateshead Gas Company and the York United Gas Company; and in 1887-8 he filled the position of President of the North of England Association of Gas Managers. The subject of his Inaugural Address on that occasion, as may be remembered, was "The Structural Capacity and Cost of Gas-Works." The opinions then put forward by Mr. Wyatt gave rise to a considerable amount of discussion. At the second meeting of the Association under his presidency, he read a supplementary paper explanatory of some points in his address. Mr. Wyatt was an authority on the construction and arrangement of gas-works; and the volumes of the "JOURNAL" contain the fruits of his special knowledge and experience. In 1881, he contributed a series of articles on "The Transport of Materials for Gas-Works," illustrated by the plans of the York, Newcastle-upon-Tyne, and Beckton works; and in the following year he put forward some suggestions for alterations in gas plant. His last communication appeared towards the close of 1889, when he wrote an article upon "Formulæ for Gasholder Strains," the result of his perusal of our review of Mr. Cripps's "Guide-Framing of Gasholders." Of late years, Mr. Wyatt had lived practically in retirement.

Adoption of the Denayrouze System in the Bournemouth Arcade.—The General Manager of the Denayrouze Light Syndicate, Limited (Mr. C. E. Masterman, Assoc.M.Inst.C.E.) has been informed that the Committee of the Bournemouth Arcade have decided to use five single Denayrouze burners for the future lighting of the arcade, in place of six incandescent electric lamps, each of 100-candle power, previously used; and the electric meter and lamps have been removed. We learn that, though the opinion was unanimous that the Denayrouze light was far superior in quality, penetration, and reliability, and at the same time more agreeable to the eyes, the Committee, before actually deciding, satisfied themselves by most severe and exhaustive tests as to the actual consumption and cost of gas required to maintain the five burners, giving a light equal to 800 candles, for one hour, as against the six electric lamps, furnishing a light equal to 600 candles. The result clearly showed that the cost of gas for one hour, giving a light of 800 candles, was only the same as that for one electric lamp of 100-candle power burning the same length of time. Mr. Masterman's correspondent says: "It is very singular that the first electric light installation supplied on the lines of a central station supply was carried out at this arcade about eleven years ago, since when the gas had to succumb. Now the electric light has had to make way again for the gas. History does indeed repeat itself."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 234.)

THE past week has come and gone again without making itself in the least degree felt in the Stock Markets. Everything was very quiet; and there was no enlivening influence to cause the smallest animation. Pretty well every department simply marked time, without either gaining or losing ground. But despite the dulness, it is remarkable how very firm everything was throughout. Cheap money may have had something to do with this; there being any amount ready to step in where an opening at a good figure showed itself. The closing again on Saturday helped to keep business low. The Money Market keeps in just the same easy condition, and seems likely to remain so for a long time, so far as present appearances enable one to foresee. Business in Gas was up to a very fair point, considering all the holiday influences at work; but it was largely confined to transactions in the leading issues. In Gaslights, the "A" opened at a slight reduction off the closing figures of the previous week, and stayed at about that point to the finish, without showing any disposition to recover lost ground. The secured issues, however, were strong, especially the 10 per cents., which changed hands on Friday at 320—a "record" price, we believe. South Metropolitan was uncommonly active, and pursued its slow upward movement with a gain of another point. Two or three deals in Commercial at good figures were marked; and the old stock rose a point. The Suburban and Provincial division were hardly noticed at all; and there was no movement in their prices. The Continental Companies all did well. Imperial ran up from 225 on Monday to 228 on Friday. But then it had a set-back; and the closing figure was 225 again. The quotation, however, stayed one point higher. Union had a rise; and European commanded top figures. Nothing else was altered, except Buenos Ayres, which, aided perhaps by the debenture conversion scheme, had a further rise. There was rather more doing in Water than in the preceding week; and the tendency was all in favour of better prices—several leading issues making very fair advances.

The daily operations were: Business was not particularly brisk on Monday; but prices were very fair for all except Gaslight "A," which fell 2. In Water, New River advanced 2; and ditto debenture, 1. Tuesday was pretty well the counterpart of the preceding day; Gaslight "A" being the only weak spot on the list. South Metropolitan improved 1. In Water, New River rose 5; Lambeth tens, 2; and East London, 1. Wednesday's Gas transactions were mainly in South Metropolitan, which was steady. Imperial Continental and Continental Union advanced 2 each. Thursday's business was more evenly distributed; and quotations for Gas remained unchanged. In Water, Chelsea gained 1¼. Friday's prices were good. Gaslight "C," "D," and "E" rose 2; Commercial old, 1; Buenos Ayres, ½; but Imperial Continental receded 1. The Stock Exchange was closed on Saturday.

ELECTRIC LIGHTING MEMORANDA.

A "Free-Wiring" Speculation—Imitation of the Prepayment Gas-Meter—Thin Evidence—The Cost of Wiring—A Second Free-Wiring Company.

LAST week a new electrical speculation was launched at the heads of the British public—it is to be hoped in vain. This was the National Electric Free-Wiring Company, Limited—a venture which had been shadowed forth for some time in connection with certain weakly electric lighting undertakings. The difficulty of popularizing electric lighting in sundry places has led to attempts to copy with this object the automatic prepayment system which has proved so successful with gas; but, of course, the electricians could not be expected to remain contented to go slowly and quietly to work in this regard. Hardly have a few municipalities and struggling electricity supply companies in second and third class districts consented to try the experiment in question, before a big "corporation," with a capital of £250,000, must be projected to take possession of the new development, and exploit it in the familiar fashion. Thus it is that the trail of the financial serpent is dragged through and through every branch of electrical business. The idea of applying the prepayment meter system to electricity supplies is not so very wonderful a mark of electrical enterprise, seeing that those to whom it occurred had any amount of gas-supply experience to go upon. Gas managers would naturally be gratified to receive this flattery of imitation by those who usually affect to regard the gas industry and all its ways as effete, and would willingly impart to their electrical imitators every information that might be sought with the object of facilitating the copying process. The different treatment received by the idea in the two industries, however, is indicative of the wide divergency between the respective financial systems.

It is unnecessary to describe how first the experimental, and subsequently the commercial success of the prepayment meter system was worked out by the gas companies. The electricians have taken their own line, impelled partly by necessity and partly by the Stock Exchange influences that have overshadowed their industry from the beginning. They knew that without some such means of popularizing the electric light, a good many electricity supply undertakings can never pay their way. At Wallasey—to name one of the undertakings in this category—the local authorities came to an arrangement with a concern called the Electric Free-Wiring Syndicate to test a so-called free-wiring system of electric supply; and similar experiments were talked about, if not actually adopted, at Taunton, Worcester, and Blackpool. When the Shoreditch Vestry's electric supply undertaking was started the other day, great stress was laid upon the prospect of a good business being done in the district upon these lines. This was all very well for an experiment; and the prospective development of the idea was something in which everybody could take a benevolent interest.

The first formal publication of what was going on in this regard occurred so recently as the Manchester meeting (at the beginning of the month) of the Municipal Electrical Association, when a candid paper on the subject was read by Mr. W. H. Couzens, the Borough Electrical Engineer of Taunton. It was stated in this paper that a Syndicate had commenced to operate a prepayment electrical meter system in the town, and had fixed up a few meters. These instruments were described as labouring under the disadvantage of being altogether too expensive for common use. Mr. Couzens went on to say that there was no "solely prepayment" electricity meter on the market; but he spoke hopefully of a meter patented "in the names of Ellis and Atherton." The former is a Director of the South London Electric Supply Company, and Chairman of the Portsmouth Corporation Electric Lighting Committee. His name has now appeared as one of the Directors of the new National Electric Free-Wiring Company, from which it may be gathered that it is this meter which was to receive the influential patronage of the Company. How precipitately the venture has been rushed out is shown by the fact that the only bit of evidence offered in the prospectus as to the extent and nature of the business actually done by the experimental Syndicate is a vague letter dated the 2nd inst. from the "Wallasey Urban District Council Gas, Water, and Electric Light Department," which merely states, without giving a single figure, that "the extension of the lighting here has been very greatly assisted by the introduction of the Free-Wiring Syndicate's system." It is no disrespect to Wallasey to observe that this recommendation is rather thin.

The prospectus does not say anything about the metering of electricity supplies, but commends itself entirely upon the wiring part of the proposed business. This was to be done upon the method appertaining to the British Insulated Wire Company, of Prescot, who were to grant exclusive rights to use this system so far as related to house wiring. It was also stated that at Wallasey the prime cost of the installations, wiring and fitting complete, worked out to an average of 12s. 4d. per 16-candle power lamp, for material and labour. In making up the estimate of profit, this cost was taken at 15s. per lamp. No sooner had this estimate been published than seven respectable firms of electric and gas fitters, including the well-known houses of Verity and Strode, sent a combined protest to the newspapers asserting that "so far from the sum of 12s. 4d. representing the average prime cost of wiring per light, with fittings," they had found that "this sum barely covers the cost of the materials, without any provision for labour—an item which frequently costs as much as the materials. We may add," these authorities go on to say, "that double the sum, or 24s. 8d., with plain ornamental fittings, is much nearer the mark." This information is worth placing upon record. The firms proceed to state, with cynical candour: "We have little doubt we shall be denounced as interested parties; but as we do not anticipate that anyone but the working classes would be willing to pay such a high rate of interest for the accommodation offered, our only anxiety is to prevent our clients from thinking that we are making large profits at the prevailing rates—a fact which our books would show is far from being the case." This is a double-edged statement which cuts up the prospectus wofully in a vital place. For our own part, the most deplorable feature of the new project is the proof it supplies that financiers will not let the unfortunate electric supply industry alone to work out its own proper developments in the ordinary way of business. The moment any promising aspect of the industry looms in sight, it is pounced upon by the men of the "City," which is enough to make local authorities and respectable lighting companies shut out every new proposal tending to foster the growth of this tender plant.

On Saturday, a second free-wiring advertisement came out, asking for the more modest capital of £50,000 in the name of "The Penny-in-the-Slot Electric Supply Syndicate, Limited." The Chairman is Mr. Henry Woodall; and the meter to be exploited is that of Mr. C. O. Bastian, which was characterized by Mr. Couzens, in the paper above mentioned, as being the first of its class in the field.

The Storage of Carbide of Calcium.—It has been prescribed by an Order in Council that 5 lbs. of carbide of calcium may be stored without a licence, provided it be kept in separate substantial hermetically closed metal vessels containing not more than 1 lb. each.

THE DESIGN OF ELECTRIC LIGHT AND GAS FITTINGS.

An electrical contemporary, "Lightning," has recently issued a special number devoted to that most troublesome of all problems of electric lighting—the satisfactory adaptation of incandescent electric lamps to the decoration as well as the illumination of domestic interiors. We have given particular attention to this publication, not only with a view to ascertaining what electric lighting artists have to say for themselves; but also with an eye to discovering in what respect their labours and achievements might be helpful to gas-fittings designers. The duty has not been altogether a pleasant one, and the results are not commensurate with the pains by which they have been procured; for the reason mainly that this particular periodical aims at being "popular" and "commercial," which means, in connection with a technical subject, "twaddle" and "puff." However, with due allowance for these failings, it has been possible to ascertain clearly enough what our contemporary's ideas are with respect to the application of incandescent electric lamps for the lighting of different parts of an Englishman's residence in this present year, when, as we are genially informed by way of preface, "gas, as an artistic and decorative light, is on its last legs, electricity is in demand everywhere, and decorative artists are beginning to realize the enormous importance of the new ally in their efforts to beautify our homes." It may be remarked upon this general statement of the imagined facts that, if gas is on its last legs as an illuminant, these are shown by the returns of the ever-increasing output of gas undertakings to be uncommonly sturdy ones, and capable of travelling both fast and far. If, moreover, it is true that decorative artists are only now beginning to take the incandescent electric light in hand, they must be either very sluggish in fitting their work to the times, or the subject must be very intractable. Ever since the Electric and Gas Exhibition of 1882-3, our artists and craftsmen have been toying with the electric light. They had then got the length of fixing bulbs upon bottles and rigging up "shower pattern" pendants; and how much farther have they progressed since?

To return, however, to the information now offered. Beginning with the lighting of a "baronial" entrance hall, the householder is offered his choice of a selection of statuettes to stand upon the newels of the staircase and hold miniature sheet lanterns or "bouquets" of incandescent lamp bulbs—not a particularly novel or effective plan of lighting. As an alternative, he may have "an electrolier of twisted iron pendent from the ceiling"—a suggestion as to which it may at least be said that something of the kind has been done before. "Single lights in 'Holophane' globes hanging from the centres of the arches would be another charming method of lighting the upper portion of the hall and staircase." We have no objection to the use of "Holophane" globes wherever they can be suitably employed; but these aids to the effective distribution of light are not peculiar to electric lamps, It may be contended very easily that the plan of studding a ceiling with incandescent electric lamps sunk into the plaster enrichment is bad art, and produces an irritating instead of a grateful effect. Quitting the baronial hall with the vague remark that, "given space and architectural features to work to, the field for both architect and designer is almost unlimited," the reader is bidden to observe how entrance halls of less pretension to magnificence are to be lighted. Taking for an example the entrance hall of a London house of the roomy Bloomsbury pattern, we are shown how "the low domed ceiling, with its intersecting groins, presents five effective points for the location of single lamps enclosed in hemispherical shades"—groined ceilings being, of course, common features of the residence of the middle-class Briton, and the number of lamps to be used "no object" to him. One somewhat special method of lighting a hall is, however, described. This is a hanging lantern in the shape of a very flat saucer, suspended by four chains, and lit up by, while concealing from direct view, three incandescent lamps. This pattern of lamp opens up the question of lighting by reflection from the ceiling, or from some surface disposed in the same relation to the source of light; but the question is not gone into in this connection.

The subject of wall brackets cannot be long kept out of such a dissertation; and accordingly we learn that such appliances are "thoroughly in keeping with a room of moderate size." But it has been generally understood that it is to gas that the householder owes the safe and convenient wall-bracket. Certainly, the general ideas of wall-brackets, standard table lamps, and pendants were in existence long before the electricians came into the lighting business; and all they have done in these lines has been in the direction of modifying patterns to suit their particular illuminant—an attempt in which success has not by any means been easily or generally attained. Indeed, just as the type of the oil-lamp clung to the early designers of gas-fittings, and led them into many incongruities, so the "electrolier" is often only a gas-fitting turned the other way about. Where the gas-bracket of necessity looks up, the electric fitting looks down; and this, in the majority of examples, is the chief difference between them.

There remain some special varieties of interior lighting which electricity can claim for its own, less by right of discovery than of peculiar adaptability. We say nothing about the imitation of candle light upon which electricians pride themselves, in such hopeless disregard of the rule that links art with truth. There is, once more, ceiling lighting, or lighting by reflection, which is continually being advertised as a novelty; and there is the local lighting of clock-faces, friezes, beds, and other detail applications, to which it may freely be admitted here that electricity lends itself with a high degree of convenience. Gas has suffered much in the past from the unintelligent way in which the lighting points have been distributed, especially in bedrooms. The natural immobility of a gas connection has been exaggerated into a nuisance through the lack of imagination of ordinary "three-branch hands," whose notions (say) of the use to which a lady puts her dressing-table have been of the haziest. This gives point to the inquiry: "How many sleeping apartments are there with the illumination so arranged that you can do your hair in comfort at the dressing-table, sit by the fire to read your prayer-book with ease and devotion, and, if so disposed, spend a wakeful hour in bed over the latest novel, without spoiling your eyesight or endangering your life? Few indeed." This conclusion is not quite fair to gas, which can be, and in very many cases is, made to light bedrooms as they should be lighted.

With respect to the use of electricity for lighting corridors, odd corners, and offices, it is undeniable that a good deal of gas is usually wasted in lighting such places, which are left to the extravagance and thoughtlessness of servants. Of course, with electricity waste is "unnecessary," inasmuch as the lamps can be turned on and off without trouble. But are they invariably so handled by those who have no more interest in saving electricity than they have in economizing gas? It is asserted, however, that electricity ought to replace gas in the ordinary London basement kitchen. "Electricity may be a little dearer than gas, though that is fast becoming a very questionable assertion, and will soon cease to be a tenable proposition. (?) Supposing this, however, to be the case, there are several arguments in favour of ignoring the fact, in view of the many advantages of electricity. One is a saving in paint and whitewash. However long the decorations upstairs may be made to last, a gas-lighted London kitchen must be washed over at least every year, or it becomes an eyesore to any self-respecting mistress." Let us pause here to inquire whether the cause of health is supposed to be served by sparing the whitewash-brush in an underground London kitchen? Most of the town houses of the Metropolis, and of the older provincial towns, were built when sanitary science was not; and whatever the system of artificial lighting selected for these regions, it would be a sad blunder to attempt to save out of the regular cleaning bill the higher cost of a fancy arrangement.

The conclusion of the whole matter is not difficult of definition. Electric lighting being itself a luxury in comparison with the homely gas, a greater range is offered to those decorators and users who would dress it luxuriously. There is no point in the observation that gas-fittings are inelegant because the old gaselier or bracket is, after all, only a gas-pipe in disguise. What is the electric lamp but a continuation of a piece of wire? By the same reasoning, such a fitting must necessarily be as wire, wiry. The real source of whatever is unsatisfactory in both gas and electric light fittings, as our electrical friends will learn some day, is the exceeding poverty of human invention in the matter of new designs combining utility and beauty in any application. It is not the domain of artificial lighting alone that suffers from this cause. Furniture, metal work, interior decoration—there is no show of ability anywhere in designing things fitted for modern requirements. Our engineers and shipbuilders can build and equip a yacht that shall be a perfect triumph of the adaptation of means to ends; but the decorator must needs trick out the saloon after the style of some dead and gone Louis of France, who never saw a steamboat. Where is place and setting to be found for a good honest gas-burner or electric lamp in all this imitative decoration of interiors ashore and afloat, with its irritating make-believe? They are modern, real, and original; and consequently the clever copyists who call themselves architects and decorators can no more deal with them than they can with that other modern luxury, the easy-chair. If anybody desires to know how completely our æsthetic designers are out of touch with the requirements and conditions of modern life, let him go to the next Arts and Crafts Exhibition; and if he finds a comfortable seat or a passable lamp-post there, it will be the greatest marvel of the age.

The Reconstruction of a Gasholder at the Old Kent Road Gas-Works.—Referring to the article that appeared in the "Journal" for the 15th ult. (p.1350), describing the method employed for effecting the addition of a third lift to one of the South Metropolitan Gas Company's holders at the Old Kent Road station, we have to record that the operation indicated at the close of that article as involving some risk—the re-lifting of the old crown sheeting which had been allowed to hang without support—was successfully performed last Wednesday. Air was blown into the holder until the hanging crown was raised to the normal shape of the dome; the movement of the sheeting commencing at the outer edge, where the thin sheets were connected to the strong plates next the curb. The centre was the last part of the dome to rise. The operation was carried out without a hitch, the strength of the old crown proving quite equal to the demands upon it.

COMMUNICATED ARTICLE.

SODIUM FERROCYANIDE.

By H. F. FERMOR,
Assistant-Demonstrator in Chemistry at the Goldsmiths' Institute, New Cross.

At the recent meeting of the Incorporated Institution of Gas Engineers, Dr. Colman, of the Saltley Gas-Works, Birmingham, stated that he had found that crystallized sodium ferrocyanide contains 10 molecules of water of crystallization, not 12 as commonly given in the text-books—that is to say, the formula of the compound must be written:

$Na_4FeC_6N_6\ 10H_2O$, *not* $Na_4FeC_6N_6\ 12H_2O$.

In view of the fact that cyanogen is now largely recovered from crude coal gas in the form of this salt, it seemed to be of sufficient importance to attempt to place the question of the formula of crystallized sodium ferrocyanide beyond doubt; for it will be noted that if the crude material obtained at gas-works is to be sold on the basis of the crystallized sodium ferrocyanide which it contains, its valuation will be excessive if the analysis of it be based upon the 12-molecule formula, when as a fact the 10-molecule formula is correct.

The salt is only of value for the cyanogen it contains—

$Na_4FeC_6N_6\ 10H_2O$ contains 32·23 p. ct. of cyanogen.
$Na_4FeC_6N_6\ 12H_2O$ „ 30·00 „ „ „

A search was instituted among the authorities for analyses of this salt, with the following result: Wurtz's "Dictionnaire," I., Part ii., p. 1101, Gmelin's "Chemistry," VII., p. 478, Ladenburg's "Handbuch," III., p. 101, Fehling's "Handbuch," III., p. 243, Frémy's "Encyc. Chimie," II., Part ii., p. 389, and Watts's "Dictionary of Chemistry," I., p. 337, all give formula as containing 12 molecules of water of crystallization. Berzelius obtained 39 per cent., while Pebal ("Annalen," 233, 165) gives 10 molecules of water.

The experiments undertaken were performed on two samples of the salt purchased in the London market at a long interval of time, and from different dealers. The samples were commercially pure and well crystallized. They were analyzed for probable impurities, such as the potassium and calcium ferrocyanides, and were found to be free from these. Re-crystallization was adopted as a means of purification both from hot water and from alcohol. From the following figures, it will be seen that the balance of evidence is in favour of the formula $Na_4FeC_6N_6\ 10H_2O$ for the crystallized salt:—

Calculated Numbers.

$Na_4FeC_6N_6$	$9H_2O$	should contain	34·76 p. ct. of water.
$Na_4FeC_6N_6$	$10H_2O$	„ „	37·19 „ „
$Na_4FeC_6N_6$	$11H_2O$	„ „	39·44 „ „
$Na_4FeC_6N_6$	$12H_2O$	„ „	41·42 „ „

Experimental Numbers.

—		Weight Taken.	Loss on Heating.	Loss. P. Ct.	Temp.	Remarks.
		Gramme.	Gramme.			
Sample A. Purchased July, 1896.	1	0·8045	0·3025	37·60	122°	Recrystallized from hot water.
	2	0·4010	0·1485	37·04	130°	„ „ „ „
	3	0·6275	0·2335	37·21	100°	„ „ „ „
	4	0·3390	0·1275	37·61	125°	„ over H_2SO_4
	5	0·7290	0·2710	37·17	130°	„ from hot water
	6	0·4205	0·1595	37·93	130°	„ over H_2SO_4
Sample B. Purchased May, 1897.	7	0·5358	0·1928	35·98	130°	„ from alcohol
	8	0·6115	0·2260	36·95	130°	As purchased
	9	0·7920	0·2905	36·68	130°	Recrystallized from alcohol
	10	0·7490	0·2830	37·78	130°	„ „ hot water
	11	0·5860	0·2195	37·45	100°	„ „ „ „
	12	0·6000	0·2250	37·50	130°	„ „ „ „
	13	0·5635	0·2115	37·53	[?]	Dried over H_2SO_4 in desiccator
Samp. A.	14	0·5090	0·1835	36·05	100°	As purchased.

In conclusion, it may be added that some of sample B was left exposed to the air for 14 days in fine warm June weather, with a view to test the statement that the salt is efflorescent. It had lost during this time 0·99 per cent. of its weight.

Carbide of Calcium as an Insecticide.—With reference to this subject (on which a paragraph appeared in a recent number of the "JOURNAL") we learn that as far back as June, 1895, Mr. F. G. Worth, the Secretary of the Acetylene Illuminating Company, Limited, took out a patent in France for destroying *phylloxera* and other insects by means of carbide of calcium or other metallic carbides. Experiments since made, however, with the carbide as manufactured for lighting purposes, have not been successful. It was not only not sufficiently poisonous, but the insects seemed rather to enjoy it. The investigations are being continued with the view of producing a special carbide which will be thoroughly destructive. M. Chuard's experiments were made quite independently of those above referred to, and, of course, at a much later date. The *phylloxera* trouble is one of many years' standing; and if the trials now in progress should result in the production of a material which will get rid of it, the discoverers will earn the thanks of the vine growers of France.

TECHNICAL RECORD.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The Second Annual Meeting of this Association was held from Tuesday to Thursday last, at the Westminster Town Hall. It was disappointing to find that, notwithstanding a continued increase in the membership, there was a falling off in the attendance compared with last year's meeting. At the commencement of the proceedings, Mr. D. M. F. GASKIN (Nottingham), the retiring President, occupied the chair.

CONFIRMATION OF MINUTES.

The SECRETARY (Mr. W. H. Brothers) first presented the minutes of the last meeting; and they were confirmed.

THE FORMATION OF WATER BOARDS.

Mr. GASKIN said the *agenda* stated that there would be a short address by the retiring President. It had been his intention to make a few remarks on the question of the formation of Water Boards. But he understood that the President would refer to it in his address; and therefore he would merely allude to one or two points bearing upon it. At the recent conference of the Institution of Civil Engineers, Mr. James Mansergh read a paper on "The Law and Allocation of Underground Water;" * and this appeared to him (Mr. Gaskin) to be a subject to which Water Boards might well turn their attention. It was well known that the Nottingham and Newark Water Bills had been what he might call test-cases in the parliamentary work of the present session. As the Water Engineer of Nottingham, he had had a considerable amount of trouble in the matter; and the conclusion he had come to was that Water Boards would, in such cases, be a distinct advantage, instead of wasting the ratepayers' money as was done in this particular instance. Without making any attempt to criticize Mr. Mansergh's paper, he desired to say that, in the event of Water Boards being formed, the men composing them should, in his judgment, be technically educated, and free from all local interest. It was well known how much local influence had to do with the passing or otherwise of Bills by Parliamentary Committees, and also that the side which had the most skilful Counsel had the best chance of winning their case. The result of the eighteen days' discussion of the Bills in question was that neither Corporation got what they wanted. He felt certain that, if the Bills had been investigated by a Water Board composed of technically educated men, who, after receiving evidence, had viewed the districts, and seen for themselves the prevailing conditions, both Nottingham and Newark would have got a great deal more than they did. He concluded his remarks by moving that the Committee on Water Boards be re-appointed.

Mr. H. ASHTON HILL seconded the motion.

Mr. W. WHITAKER, F.R.S., F.G.S., thought the proposition was a good one; but he was not sure that it would not be better to have a Standing Committee to watch any question that might occur. They found that the most unexpected things cropped up. In the Nottingham and Newark cases, the important point, in his opinion, was the idea of a protective area. He thought the same thing would be found in Water Bills in future; and it would have to be carefully watched to see that justice was done. He was afraid that the reason why the protective area was not granted in this case was because too great an area was asked for. If these Bills had been referred to an expert body, a fair compromise would, no doubt, have been speedily come to. The Parliamentary Committee, he believed, owned they had had no experience in such matters; and it was hard that the ratepayers of Nottingham and Newark should have had to pay for the Committee learning their work. Instead of fighting among themselves, he thought there should be a federation of small neighbouring local authorities in obtaining a supply of water from the same watershed.

Mr. F. J. BANCROFT (Hull) cordially supported the proposition; for in Hull they had suffered in somewhat the same way as had been referred to. In 1892 or 1893, a small Company on the outskirts of the town proposed to sink a well about two miles from one of the most important of the Corporation wells. The Parliamentary Committee who had to decide the matter would not unfortunately give a protective area to Hull; but they sanctioned the sinking of the opposition well in the chalk formation, which would have materially affected the well from which the town obtained a considerable supply of water. The result was the Corporation had to buy out, at a very large and unnecessary expense, the Company who were proposing to sink the well. If an area had been allocated to Hull from which underground water might be abstracted, this burden would not have been thrown upon the ratepayers. He was now executing some work at the well, and was taking detailed records to find out what really would have been the effect of pumping at the distance named.

The motion was carried; and the Committee (consisting of Messrs. Gaskin, Hill, Matthews, and Paskin) were re-appointed, with the addition of Mr. Whitaker; power being given them to further add to their number.

* See "JOURNAL," Vol. LXIX., p. 1240.

ELECTION OF OFFICE-BEARERS.

The Scrutineers of the balloting-lists for the election of officers (Messrs. C. Sainty and T. L. Hughes) reported that the following gentlemen had been elected:—

President.—Mr. H. Ashton Hill, Engineer of the South Staffordshire Water-Works Company.

Vice-Presidents.—Mr. W. Matthews, of Southampton; and Mr. W. Watts, of Sheffield.

Members of Council.—Mr. C. E. Jones, of Leyton; Mr. E. Sandeman, of Plymouth; Mr. W. Terrey, of Sheffield; Mr. F. Griffith, of Leicester; Mr. R. H. Swindlehurst, of Bolton.

Honorary Secretary and Treasurer.—Mr. W. G. Peirce, of Richmond.

The chair having been vacated by Mr. Gaskin, it was taken, amid applause, by Mr. H. ASHTON HILL.

THANKS TO THE RETIRING PRESIDENT.

Mr. WHITAKER said they could not allow this change of Presidents to take place without giving expression to their thanks to the retiring President. Without Mr. Gaskin, the Association would not have been called into being. He had been a good President, and had done his best for the welfare of the organization.

Mr. T. N. RITSON (Kendal) seconded the motion, which was agreed to by acclamation.

The PRESIDENT then read his

INAUGURAL ADDRESS.

At the outset, he tendered to the members his warmest thanks for the high honour they had done him, and then proceeded to show that the Association had amply justified its existence. It came into being only fifteen months since; and in February last, the roll consisted of 110 members and 32 associates. The President next passed in review the questions dealt with at the preceding meetings; making lengthy reference to the main point of Mr. De Rance's paper read at the Nottingham meeting, and to the appointment of a Committee to take note of what was done in the way of legislation affecting the interests indicated in that communication. He quoted some extracts touching on the subject from the "JOURNAL"—examples being the reference to Dr. Porter's paper on "The Control and Supervision of Public Water Supplies by Sanitary Authorities," read at last year's congress of the Sanitary Institute; and a notice, in the issue for Nov. 3, of "A Proposed Big Water Scheme for Pembrokeshire." Allusion was also made to the contest for the Little Don watershed, and to Mr. Mansergh's paper (previously referred to) on "The Law and Allocation of Underground Water." Commenting on Mr. Paskin's paper at the last meeting, the President cited some authentic information as to the disaster to the Bradfield reservoir of the Sheffield Water Company in 1864.

The next section of the address was devoted to an interesting description of the President's own works. It was as follows: At December 31 last, the capital of the South Staffordshire Water-Works Company's undertaking stood at £1,040,581. The water-rates for the year amounted to £92,781. The number of houses laid on in the year was 3634; making the total supplied 92,007. The limits embrace portions of the counties of Stafford, Derby, Warwick, and Worcester; its extremes reaching from within about three miles of Derby to about eight miles from Kidderminster—a distance exceeding 40 miles. It ranges up to 20 miles in width, and covers an area of 276 square miles; considerably exceeding, I believe, the area of any other water undertaking in the country. It comprises within its limits 48 towns or parishes, and includes among its large towns Burton-on-Trent, Walsall, Wednesbury, Hednesford, Cannock, Brownhills, Pelsall, Darlaston, Tipton, Dudley, Brierley Hill, Rowley Regis, Cradley, West Bromwich, Oldbury, and Smethwick. The population of the whole area is probably about 565,544; and the actual population supplied, based upon the census returns of 1891, and allowing five persons per house, 460,035 (92,007 × 5 = 460,035). Owing to the diversity of levels of the district, ranging from 130·9 feet to 892·5 feet above Ordnance datum, it is necessary to re-pump a considerable portion of the water twice in addition to the first pumping. The maximum quantity of water supplied per day during the present year reached 12,233,496 gallons on May 22; the whole having been pumped mostly from deep wells. The total quantity pumped for the year 1896 was 3,206,000,000 gallons, of which 871,000,000 gallons were for trade use. The supply to the whole of the area covered by the Company's operations is constant and unlimited. The system of waste inspection is by ordinary stethoscope, principally at night time; outside stop-cocks being fixed to all service-pipes.

One of the principal sources of supply is at Lichfield, where there are three impounding reservoirs connected with a tunnel about 3¼ miles long driven through the red sandstone. The streams collect water from the neighbourhood of Cannock Chase and Lichfield; the tunnel affording a supply from numerous springs along its course. In September, 1895, I had an opportunity of gauging the relative minimum yield of the two main streams, and of the tunnel and well separately (using the formula $5{\cdot}15\ \sqrt{H^3}$ = cubic feet of water per minute per foot width of weir), and found that each of the two streams yielded approximately half a million gallons in the 24 hours, and the tunnel about 2¼ million gallons. The maximum daily yield of the streams may be taken as upwards of 67 millions and 10 millions respectively.

The number of reservoirs owned by the Company is fifteen, and there are eleven pumping-stations. The total reservoir capacity is 195 millions; and the number of engines 25, and boilers 39. During the past two years, new engines have been erected and set to work at three of the pumping-stations—viz., a horizontal, differential, compound, surface-condensing engine, of a capacity of 1½ million gallons per 24 hours; a horizontal differential, compound, surface-condensing engine, of a capacity of 1 million gallons; and a vertical, rotative, compound, surface-condensing engine, of a capacity of 1½ million gallons. The engines in use are of various types; the total actual horse power being 2700. The boilers are mostly of the Lancashire type—*i.e.*, double-flued cylindrical—and have, on my recommendation, been insured with one of the boiler insurance companies. I would like to advise, if it should be necessary, the members of the Association to adopt the same course. It is false economy to take upon oneself the responsibility of accident, when it can be put into the hands of an organized company having trained men to make regular and systematic inspections—in fact, I think it will in time become compulsory for some such system to be adopted by all steam users. It is astonishing how far a boiler can be worked before its real state becomes known. I have, in the course of my experience, on several occasions, taken out boilers that have had portions of their plates resting on wide seating walls, which have not been more than $\frac{1}{16}$inch in thickness; showing that, but for the brickwork, the plates would have long since blown through.

When surface condensers are used, there is a disadvantage in dealing with the oil used for lubricating the cylinders—first, there is the question of keeping it out of the boilers, and, secondly, in some instances, of keeping it out of a stream; and an experience of mine in this matter may be useful to others. Some engineers allow the condenser water to be discharged to waste, preferring to sacrifice the hot feed to the risk of putting the grease into the boiler. If this water is discharged into a sewer or into a canal, well and good; but if into a stream, and more particularly into a small brook or ditch which subsequently joins the stream, difficulty is likely to arise from pollution. In my own case, the practice had been to allow the boiler-feed tank to slightly overflow continuously, in order to allow the grease to pass away into the ditch; and this apparently innocent arrangement led to considerable difficulty with the landowner and the farmer. Now the only alternative was to keep the water on the premises, which involved the pumping of the feed-water into the boilers. The next point was to introduce a feed-water filter, and make a sump into which to blow off the filter as required, from which the grease could be taken and put on to the slack and burned; but there remained the question of freeing the water from the grease when a boiler was blown down; and so I designed a simple filter. The contents of the filter are riddled engine ashes; and it only requires emptying, and the ashes removed, at long intervals. When I had carried out these alterations, I thought I had disposed of the cause of complaint, but it was not so. My attention was called to a discoloration of the water discharged by the drain-pipe from our land; and an examination for the cause led to two reasons being advanced—one, that the ground showed signs of containing an ochry deposit; and the other, that the heavy rains of the past winter falling upon a heap of some 300 tons of slack, aided by the general weathering, had dissolved out an appreciable quantity of iron oxide, quite sufficient to account for the complaint. The next obvious course was to erect a shed over the coal, which, apart from the reason in question, is a wise thing to do; and this is now in hand. I have mentioned this apparently trivial matter at length, because, although trivial, it had all the elements of a serious lawsuit in it. It certainly goes without saying that water authorities, who are essentially jealous about the pollution of their streams, should be the last to contribute even in the slightest degree to the pollution of anybody else's stream.

In supplying a district having considerable variations in level (such as I have referred to), and where it would be costly, if not impracticable, to divide it entirely into zones of pressure by means of reservoirs, it appears to me that much might be done by the judicious adoption of break-pressure tanks or reducing-valves. I have recently designed a valve and applied it to 12, 8, and 4 inch mains with very satisfactory results. The valve is actuated by the low-pressure water, and maintains a constant pressure no matter what variation takes place on the inlet. Where the pressure enters a district at (say) from 180 to 190 lbs., the advantage and necessity of reducing it to 50 or 60 lbs. is obvious. In one of my districts, a wheel main supplies a town from a pumping system uncontrolled by a reservoir. There are two stations pumping into this main; and the pressure in the pumping-main varies from about 140 to 190 lbs. The pressure on the gauge at the district superintendent's house formerly varied between 80 and 136 lbs.; and, as some parts are at much lower elevations, the pressure on the mains and services in certain cases exceeded 150 lbs. By fixing reducing-valves on the two arms of the principal main at suitable points, and adjusting them to deliver water at 60 and 50 lbs. respectively, so as to suit the levels at which they are fixed, the pressure on the gauge at the superintendent's house is now about 60 lbs. throughout the day and night, or an

average reduction of 48 lbs., and a reduction from the maximum pressure of 76 lbs.

The President, after expounding a water engineer's duties, said: If this address were open to discussion, I should hesitate to refer to the water-finder; but I cannot forbear to mention that recently a Government auditor has surcharged the expenses of a local authority for employing an "expert" of this kind. I have often wondered how long these gentlemen would survive if they were called upon to advise water authorities who were in the habit of looking for such supplies as (say) 1000 gallons per minute or more. I do not by any means wish to infer that an engineer should not be prepared to consult a specialist when occasion requires. It would oftentimes be desirable to do so; and I think that every engineer should in a matter of this sort, before proposing the expenditure of a large sum of money, be ready to recommend the calling in of some eminent geologist familiar with the particular district before the final step is taken. In fixing upon the site for a well, it is important to note from what direction the water may be expected to come; so that, if it is near the sea for instance, calculations must be made of the area of exposed pervious rock, in order that a regular supply from the watershed may be relied upon, otherwise infiltration of sea water will be likely to take place. In a case in my experience, some remarkable differences in the results of analyses were obtained of water from two wells situated within 20 feet of each other, which indicated that the source of supply to one of the wells was affected by direct connection with the sea, while the second well was not, or, if at all, to a minor extent.

With regard to the question of pumping from wells compared with having pumps in boreholes, differences of opinion will no doubt exist; but it is certain that both can be carried out successfully. I have both systems at work; and a member of this Association once told me that, so satisfied was he with a borehole installation at his own works, he would never sink another well. As regards cost, I find that the pumping-station with a borehole scheme to raise a million gallons per 24 hours was £15,989, compared with the cost for three other stations of the like capacity, and constructed about the same time, of £14,616, £14,852, and £16,144 respectively. These prices include everything, except land and workmen's cottages. There can be no doubt that the borehole system has the advantage of being able to lower the pumps to a greater depth from the surface as the water-level descends; and the full capabilities of the site can be ascertained more readily than by sinking and boring.

With respect to service reservoirs, perhaps I may be allowed to say a few words, seeing that I have recently had to review the subject in connection with the design of three reservoirs—one of a capacity of 4½ million gallons; the second, 3¼ millions; and the third, 10 millions. The first point I would wish to speak upon is that of uniformity; and this has been upon my mind in consequence of our Past-President's plea for uniformity in connection with regulations for the prevention of waste, and also Mr. Paskin's proposed resolution on the same subject. It has also occurred to me in connection with the subject of meters and other matters. While an advocate for uniformity and standardizing, where possible, I have been driven to the conclusion that the laws of Nature govern these matters far more than is often realized. What a humdrum existence ours would be if everything were planned on a principle of uniformity instead of the diversity which exists in Nature; for are we not told that no two blades of grass are alike? So it is in the sphere of water-works engineering, taking for an example the case of reservoirs. Different towns and different conditions require as varied treatment—for instance, a 10 million gallon reservoir in one town or district is called a service reservoir, whereas in another town it would be a storage reservoir. Then the text-books say that a service reservoir should be covered; therefore the question arises, What is a service reservoir? I think perhaps the best answer would be that it is a reservoir of a capacity not exceeding (say) three days' supply to the district which it controls; so that if it contained 3 million gallons, the pumps would deliver into it a million gallons per day—thus ensuring a thorough change of the water contained therein. This is assuming that the pumping-main delivers the water direct into the reservoir, which will in this case have a separate outlet-pipe. Where this arrangement is possible, there can be no doubt that it is the best method for maintaining the water in a state of purity. But this is not always practicable; for in some cases the pumping-station is situated at a low level, and, in order to gain a sufficient head, a site for the reservoir has to be sought at a considerable distance beyond the area of supply, so that the pumping-main has to be laid (say) for a couple of miles beyond the town. It would, therefore, involve the laying of a second main if the conditions laid down in the first scheme were to be adhered to. As a matter of fact, it would be sufficient if one main only were laid with a branch to the town; but it will be evident that supposing that one million gallons per day are pumped, it will only be the difference in demand from hour to hour from the normal quantity pumped that will either go into or come out of the reservoir. Consequently, when there will be only a comparatively small change of the water, the size of the reservoir should be proportionately reduced. No hard-and-fast rule can be laid down, because in a town where the population is not a very rapidly increasing one, and there are duplicate engines, a reservoir constructed under the last-named conditions would, perhaps, be sufficiently large if of a capacity of a million gallons, whereas in the first-mentioned case the engineer would be justified in proposing one of 3 millions capacity.

Another point arises out of the above considerations; and that is as to the absolute necessity or otherwise of covering service reservoirs. When the conditions of the last-mentioned reservoir and supply exist, it is undoubtedly advisable to cover. If, added to the other circumstances, a reservoir is situated near the town, where local contamination from chimneys and dust may be expected, it becomes absolutely necessary to cover. But in the case where the water is frequently changed, and the site is upon a hill miles away from a town, and the reservoir—comparatively small—is constructed with vertical or nearly vertical sides and with paved or concrete bottom, it appears to me that, if such a reservoir be regularly washed out, it is not so necessary that the great expense of covering should be entertained. Of course, this matter would be further affected by the class of water; and if experience in any particular case disclosed special liability to vegetate, or become otherwise contaminated, it would undoubtedly be necessary to cover. A cogent argument in favour of constructing open reservoirs is that of the saving of expense; and although it may be said that this should be a secondary consideration, still there are many cases where the means at the disposal of a town are sufficient to carry out a satisfactory and economical scheme, whereas a more costly one would be out of the question.

The present is an exceptionally favourable time where new works are in contemplation, inasmuch as money can now be raised at from 2½ to 3 per cent.; so that, in proposing the construction of a reservoir or other works to cost (say) £20,000, the additional revenue to be provided because of the increased outlay would, at 3 per cent., be £600 per annum. In days gone by, when, perhaps, money was at 5 per cent., it would have been £1000, or a difference of £400.

The President next offered some remarks on the laying of mains in new streets and districts; and he then adverted to the legal questions which crop up in the ordinary routine of the duties of a water engineer, who, he said, to be successful in his work, must have a practical knowledge, not only of the various Acts of Parliament relating to water supply as set forth in "Michael and Will," and the Special Acts of his own undertaking, but he should also have an intelligent knowledge of the working and application of the Public Health Acts. In this connection, he remarked: One matter to which I would refer is the ambiguity of the Water-Works Clauses Act, 1847, section 28 *et seq.*, with regard to the powers of water authorities for crossing railway and canal bridges, owners of which—by statutory authority, be it remembered—have in many instances so interfered with the public roads as to leave little or no covering of soil, thus necessitating either the pipes being laid through or under the walls of the bridge, or being supported on brackets attached to the structure. To do this, the consent of the owners of the bridges is required; and in some cases this consent is only given upon a payment for wayleave. I am strongly of opinion that Parliament should not allow railway and canal companies in such cases to prevent in any way the exercise of a water authority's rights, and that the only expense imposed upon it should be limited to the cost of carrying out the work necessary to make a proper job.

Other matters mentioned in the address had reference to the powers of water authorities to charge for the repair and maintenance of service-pipes and trenches; and the question of altering the level of roads by local authorities. The President concluded with an earnest appeal to members to individually do all in their power to forward the interests of the Association.

On the proposition of Mr. MATTHEWS, seconded by Mr. W. A. RICHARDSON (Birkenhead), a cordial vote of thanks was passed to the President for his address.

NEW MEMBERS AND ASSOCIATES.

The following gentlemen were admitted to the Association:—

Members.—Mr. R. Evans, of Cork; Mr. A. A. Gill, of Chelsea; Mr. E. D. Marten, of Westminster; Mr. H. P. Maybury, of Malvern; Mr. T. H. Plowright, of Brackley; Mr. J. W. Way, of Newport (I. of W.); Mr. O. Williams, of Aberdare.

Associates.—Mr. P. Bright, of London; Mr. I. Cowley, of Edinburgh; Mr. H. Hall, of Montrose; Mr. W. Hope, of Liverpool; Mr. M. Peirce, of Richmond; Mr. A. J. Price, of Worcester; Mr. I. W. M. Richardson, of Birkenhead; Mr. W. C. Starie, of Windsor; Mr. G. Watson, of London.

PAST-PRESIDENTS AND THE COUNCIL.

Mr. MATTHEWS said that, in preparing the balloting-list for office-bearers, it was found that, under the existing rules, the outgoing President would cease to be a member of the Council, unless his name was specifically put forward again. He therefore proposed certain modifications of the rules, providing that the President on retiring from the chair should continue to be a member of the Council for five years.

Mr. C. E. JONES seconded the proposition, which was unanimously adopted.

PAPERS READ.

The papers read were taken in the following order: "Some Middlesex Wells," by Mr. W. Whitaker; "The Removal of Internal Corrosion from the Mains of the Kendal Water-

Works," by Mr. T. N. Ritson; "The Torquay Water-Works," by Mr. W. Ingham; "On Pumping Machinery," by Mr. A. Towler; "The 'Venturi' Meter in Relation to the Measurement of Water in Large Mains," by Mr. W. G. Kent; "Historical Sketch and Description of the Manchester Corporation Hydraulic Power Works," by Mr. L. Holme Lewis; "Notes on Distribution," by Mr. John Shaw; and "The Use of an Electrical Recorder for the Detection of Waste and other Purposes," by Mr. W. Coles Finch. Summaries of these papers, with notes of the remarks made upon them, will be published in succeeding issues of the "JOURNAL."

THANKS TO THE PRESIDENT.

At the conclusion of the business on Thursday morning, Mr. GASKIN proposed a vote of thanks to the President for his conduct in the chair; remarking that he was sure all would agree with him that Mr. Ashton Hill had done remarkably well in directing their proceedings.

The motion, having been passed by acclamation, was briefly acknowledged by the PRESIDENT.

ANNUAL DINNER AND VISITS.

On Tuesday evening, the members, accompanied by friends, journeyed down to Richmond for their annual dinner, which was held at the Star and Garter Hotel. Following the repast, several toasts were intermingled with music; and altogether the entertainment was much enjoyed by all able to share in it.

Thursday afternoon was devoted to a visit to the Southwark and Vauxhall Water Company's works at Hampton.

On Friday there was an excursion to Windsor and Eton; and, owing to the excellence of the arrangements made by Mr. C. Sainty, the Engineer of the Windsor Corporation Water-Works, a great deal of sight-seeing and enjoyment was pressed into the day. The morning was spent in visiting Windsor Castle and the Albert Memorial Chapel. Luncheon followed at the Guildhall; the Association being honoured by the presence of the Mayor (Sir G. H. Long, J.P.) and Ex-Mayor (Mr. Bernard Westlake). In welcoming the visitors, his Worship made some complimentary remarks as to the manner in which the Corporation water-works were managed by their Engineer. After luncheon, Eton College Schools and Chapel were inspected, and then both the Corporation and Castle Water-Works. A delightful three hours were next spent in a trip on the river to Maidenhead and back; and the day wound up with tea at the Windsor Town Hall—the opportunity being taken to cordially thank Mr. and Mrs. and Miss Sainty for the admirable arrangements they had made. The number of members and friends who participated in the outing was about 65.

Mixtures Containing Ethane.—In a paper submitted a short time ago to the Physical Society, Dr. Kennen described some experiments made in continuation of a research on the condensation and critical phenomena of mixtures of ethane and nitrous oxide, the results of which were published last year. The author has now investigated mixtures of ethane and acetylene, and of ethane and carbonic acid; and he finds for them similar properties to those of mixtures of ethane and nitrous oxide. The first part of the paper referred to the preparation of ethane, and the effect of impurities on its vapour pressure, and critical constants. Ethane from ethyl iodide is not very pure; it has generally an admixture of a substance of higher critical temperature and higher density than itself. This substance is probably butane. Ethane produced from sodic acetate by electrolysis is nearly pure. The method of preparation was described by the author. The pressure and corresponding volumes during condensation were given for this substance at various temperatures.

Gas-Engines for Electric Lighting.—The Manager of an American Gas Company recently communicated to the "Electrical Engineer" of New York the following testimony to the value of gas-engines for supplying motive power in electric light stations: "We have had a 50-horse power 'Otto' gas-engine in use in our electric plant for seven years, and are installing a second engine of the same size and make, and intend installing a third in the near future—making 150-horse power in all. We have been using a 50-horse power Westinghouse 'Standard' along with the Otto; the two being belted to a line shaft carrying a balance-wheel weighing about 3000 lbs. From this shaft are belted a 50-light Thomson-Houston arc machine and a 1000-light Westinghouse alternator. The service is perfectly satisfactory, although the engine is governed on the hit-and-miss principle. Leaving out of consideration the items of boiler attendance, repairs, &c., we have found that coal gas at 30 c. per 1000 cubic feet is equal to coal at $2 a ton. In this connection, I might mention that our engines are of the older type, and use at least 20 per cent. more gas than more modern engines. With us the cost of lubrication is a very small item, as we use only about 3 pints of filtered oil, 1 pint of cylinder oil, and ½ lb. of grease for an eight-hour run. This would make the cost of lubrication less than 0·1 cent. per kilowatt-hour. The ignition tubes cost 1¾ c. per day. The repairs amount to about $50 per annum on an average, or about 0·1 c. per kilowatt-hour. I consider that any company operating both coal-gas works and electric plant will be largely benefited by using gas-engines."

SOCIETE TECHNIQUE DU GAZ EN FRANCE.

The Papers Read at the Annual Congress.

(*Continued from p.* 163.)

GIROUD AND SAPPEY'S COIN-FREED METER WITH ONE OR MORE TILLS.

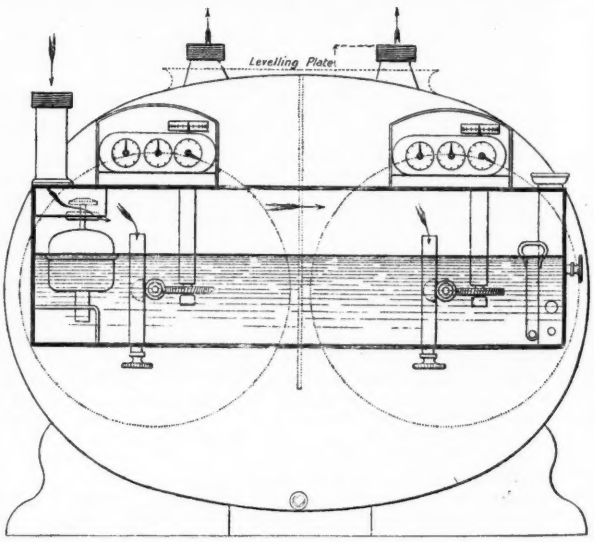
M. Giroud described and explained this meter, of which an illustration and full description were given in our "Register of Patents" on March 23 last (p. 655). He stated that it was impossible that the consumption of gas should be at variance with the money collected in the till. There was not incessant friction during use; and the appliance could be readily fitted in the shops of the gas-works to any wet or dry meter. Two tills, to either of which the travel of the coins could be directed by means of a key kept by an inspector, afforded a check on the collectors.

AN APPARATUS FOR SUPPLYING GAS BY THE HOUR.

M. Dupoy described a coin-freed clockwork device for furnishing a predetermined quantity of gas equal to a given number of hours' consumption, either uninterruptedly or at intervals as desired. A tap on the gas-pipe was connected to the clockwork, so that when the gas was turned off, the clockwork was arrested also, but was again brought into play when the gas-tap was opened. Thus the quantity of gas paid for by one coin could be burnt continuously, or in several portions at intervals. The device was intended for use on the different services of a large installation, to which the supply was measured by an ordinary meter. It was specially suitable for use in the rooms of hotels, where the visitor could obtain by the insertion of a coin (say) two hours' supply for a gas-fire, and yet have the power of using this supply in shorter periods, until two hours of actual consumption were completed. A very similar invention to that described by M. Dupoy was described in our "Register of Patents" on June 16 last year (p. 1339).

A METER FOR A TWO-PRICED GAS SUPPLY.

M. de Billy read a short paper, in which he explained that the supply of gas for heating purposes at a lower price than for lighting had been viewed with disfavour by many gas-works and by many consumers, because it was necessary that two meters should be installed. The gas-works thus had the labour of inspection duplicated; and consumers objected to being encumbered with two meters. He had found a remedy for these

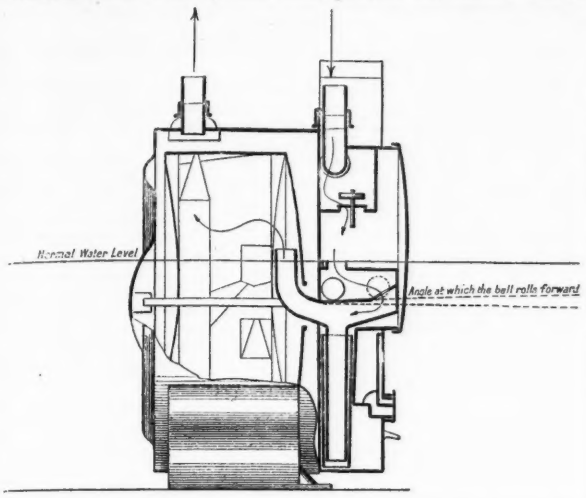


objections in the duplex meter, of which a sectional elevation is shown. This consisted of the drums of two 3-light meters, with separate indexes. Both drums were in one elliptical case, with a diaphragm inserted between them; but the water communicated freely, and had the same level on both sides. There was only one inlet-pipe, but a separate outlet-pipe for each drum. The cost of such a meter was little lower than that of two 3-light meters; but the water-level varied much less, owing to the greater volume of water within. The cost of supervision was therefore reduced; and the space occupied by the meter was less than that required for two ordinary ones. Its extreme width was 19 inches, and its height 16 inches.

A DEVICE FOR THE PREVENTION OF FRAUD BY THE TILTING OF WET METERS.

The ball syphon of MM. Perthuis and Guillemet, for adaptation to consumers' wet meters, was described by M. Maldant. Very similar apparatus was introduced by M. Bruxelles, and briefly described in the "JOURNAL" for Sept. 29 last (p. 596). Both devices depended on the closure of an orifice at the upper end of a slightly inclined plane, by a ball which rolled forward from the lower end of the plane when the inclination of the latter was changed by the tilting forward of the meter. M. Bruxelles made the orifice in a compartment soldered on the

outlet-pipe of the meter; but the Perthuis and Guillemet device is applied to the inlet-syphon within the meter case. When a meter fitted with it is tilted slightly, the ball rolls forward, closes the inlet of the syphon, and prevents the further flow of



gas; while at the same time the pressure of the gas raises the level of the water in the drum chamber. A meter fitted with this device does not differ in external appearance from an ordinary wet meter. The accompanying sectional view shows the position of the ball before and after displacement.

The "London Manual," which has been issued by Messrs. Horace Marshall and Son under the editorship of Mr. R. Donald, is a suitable companion to the "Municipal Year Book," for which he is responsible. The object of the former work is to furnish information concerning public bodies in the Metropolis and its suburbs, professedly supplied from official sources or officially revised. In a chapter on "London's Light," the charges, profits, and Directors of the London and Suburban Gas Companies are given. The subject of water supply is dealt with at greater length in another chapter; maps of the Companies' areas being included. As there are upwards of 400 public authorities at work governing London, it has been no light task to explain their functions; but this the Editor of the "Manual" essays to do. The book is well printed and of convenient size.

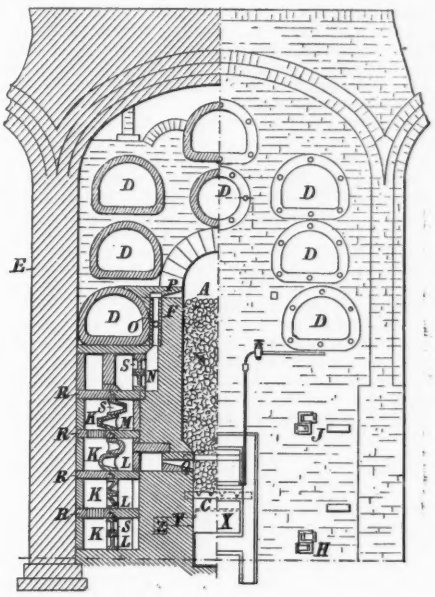
Our Coal Resources.—Since the publication in 1865 of Professor Jevons's book dealing with the subject of our coal supplies, the yearly output has risen from 98 million tons to nearly double that quantity; and in his lately issued work on "Our Coal Resources," Mr. Hull expresses the opinion that by the end of the century the quantity raised will fall little short of 200 million tons per annum. One effect must be changes in the modes of working. By the close of the century, the main supplies will be drawn from depths of 300 to 400 yards; and in the next century, these depths will be greatly exceeded. As the result of a careful examination of the coal-beds, he comes to the conclusion that nearly 82,000 millions of tons are workable at a depth of 4000 feet from the surface—an estimate far below that which the Royal Commission of 1865 put forward. He remarks that "the great northern coal-field, the seat of which is at Newcastle-on-Tyne, and which is historically the most interesting of all the coal-producing areas of the British Isles, is surely and rapidly exhausting its strength."

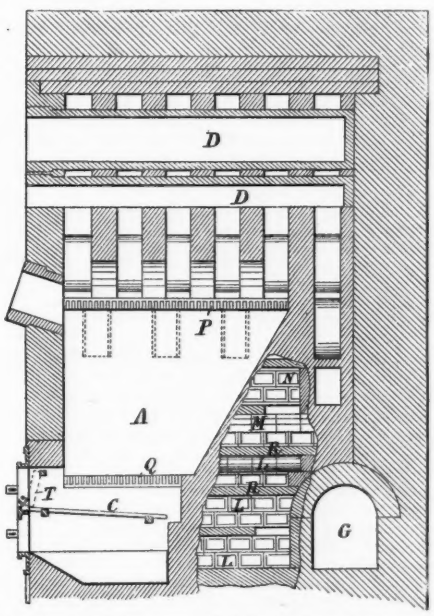
Hanssen on the "Reform of Chemical and Physical Calculations."—We have received a copy of an important work on "The Reform of Chemical and Physical Calculations," written by Herr C. J. T. Hanssen, and printed, under the patronage and at the expense of the Carlsberg Foundation of Copenhagen, in English, Danish, and German. The London publishers are Messrs. E. & F. N. Spon, 125, Strand. The contents of the book do not lend themselves readily to review; but the author's object may be gathered from his preface and from a few introductory remarks by Professor G. Karsten, of the Kiel University. Herr Hanssen starts with the proposition that the chemists and physicists of all nations should refer observations and calculations on gravity to one common circle of latitude, just as astronomers refer all determinations of time and longitude to one meridian. He compares the best determinations of the weight of the cubic metre of oxygen; and he finds that this increases from south to north. Near 41° of latitude, the specific gravity of oxygen gas of atmospheric density, at the temperature of freezing water, is found to be "exactly 700 of the specific gravity of distilled water at its temperature of greatest density." Starting with this fact, all fundamental values have been determined, and expressed with absolute exactness in units and vulgar fractions, instead of approximately by rows of decimals. The first part of the book contains calculations of absolute and relative weights; the second and larger part, calculations on heat. The results are illustrated by diagrams where required.

REGISTER OF PATENTS.

Regenerative Furnaces for Heating Gas-Retorts.—Helps, G., of Hinckley. No. 17,530; Aug. 8, 1896.

The principal features of these improvements are: 1. Increasing the area of the walls dividing the waste gases from the incoming air, without increasing the height of the flue or passage. 2. The retention of a wide joint in the brickwork of the wall between the waste-gas flue and the incoming air-flue, thus "rendering any failure of the regenerator from the mixing of the incoming air with the waste gases practically impossible, while the thickness of the wall is very considerably reduced." 3. Dividing the air supplies into numerous small streams by the use of specially shaped bricks, through which the air passes as it enters the furnace.





In the drawings, A is the generator, C the fire-bars above an ashpit, and D any convenient number of retorts arranged above and around the generator. The distance between the outside wall E and the wall F of the generator, is divided vertically into two passages K and L or M; the division wall being formed of hollow bricks. If preferred, the space between the walls could be divided into several passages alternating between air-inlets and waste-gas outlets. The waste gases pass downward through the passages K divided into any convenient number of tiers, and extend from front to back of the retort-setting, or *vice versâ*, till they reach the main flue or uptake G, which conducts them to the chimney.

The primary air is admitted through regulating-doors H, at the front of the setting and at or near the bottom. The air travels in an upward direction along passages L, parallel with the passages K, and divided from them by cellular walls built of hollow bricks S of such thickness and size as will sustain with safety the brickwork and retorts. In addition to the bricks forming the division wall being hollow, they may be made of ⊃ or other shape in section, with closed ends, so that part of each brick projects from its bed either from the waste-gas passage into the primary air passage or *vice versâ*. Further, the bricks may be set with their openings on the waste-gas passage or primary air side passage alternately.

From the upper air-passage L, the primary air is caused to pass into a

side passage having openings Q on the outlet or furnace side of small area, which taper to still smaller area at the supply, or primary air side. In this manner, the air is broken up and distributed evenly throughout the whole length of the furnace sides at a suitable height above the fire-bars; or the primary air can be conveyed directly from one of the passages or flues L, through special channel bricks Q into the furnace, without passing into the lateral passage.

A secondary air supply is introduced through doors J at the desired level in front of the setting, and is caused to travel from front to back and back to front any number of times, regulated by the height of the regenerator, parallel with the passage K, through ports left alternately at the back and front of the flue. The secondary air supply passage and waste passage K are divided by cellular bricks, as described for the primary air supply. The secondary air may also be sometimes advantageously taken between a cellular or solid wall supporting the bottom retort and the furnace-wall—see passage N—and thence through uptakes or pipes O to a distributing tile P (figs. 1 and 2). The flues are divided horizontally by ordinary rabetted tiles R, spanning from the outside wall to the generator wall, and breaking joint on the division wall or walls.

The object of introducing the projecting portion of hollow bricks into the waste gas or into the primary or secondary air flue, is to increase the heating area in contact with the waste gases considerably above that obtained from an ordinary vertical division wall, and also to baffle or break the currents of secondary air or waste gases as they travel up and down, and so utilize the maximum of the waste heat, and thereby reduce the consumption of fuel in the furnace.

The primary air, by its passage through the flues only divided from the hot waste gases by a thin cellular wall, having become highly heated, is necessarily greatly rarefied; and, being conveyed into a supply-passage, flue, or chamber of ample dimensions having a number of small outlet-passages tapering from about 3 square inches on the furnace side to about 1 square inch on the supply side (or in any other desired proportion) through which it has to pass into the generator, it is absolutely evenly distributed throughout the whole depth of the furnace sides, and in addition the flow of the heated air through the passages is by their tapered construction so reduced that no cutting whatever takes place in the furnace, and clinker is only formed in small nodules.

The primary air is admitted to the generator at a height considerably above that of the fire-bars, so that it can be highly heated without its temperature being reduced to any extent by the vapour arising from steam or water that may be distributed at the fire-bar level, and also that the position of the zone of primary combustion may be at a distance from the fire-bars. To prevent the door of the furnace frame becoming heated, a fire-brick tile shield T is introduced.

The object of heating and distributing the primary air to such an extent as described is to so increase the volume of a given quantity of air of (say) 60° that, in its passage through the fuel in the generator, it will be not only evenly distributed, but will pass through the fuel in such a condition, and at such a rate, as is conducive to economical consumption of fuel. In this manner, less primary air is required, and consequently less fuel is consumed.

When it is not desired to heat the primary air to any great extent, it can be admitted through regulating-doors fixed in front of the setting as at Z; and from this passage openings Y lead it underneath the fire-bars C. But before reaching the fire-bars, the air is equally distributed over the whole area of the furnace by a perforated iron plate X.

The secondary air, having in its passage through the flues become highly heated, is carried from the upper secondary air-flue through two or more fire-clay rectangular pipes to a passage running from front to back of the setting, on the level at which it is desired it should be introduced into the furnace. But before passing into the generator, it is caused to travel through small orifices running the whole depth of the generator from front to back—such orifices or passages being similarly constructed to those already described for primary air, as shown at P. The secondary air is in this manner broken up and distributed throughout the whole area of the generator, and so the more readily mixes with the generator gases "producing lively and perfect combustion, without any local cutting effects."

Controlling Valves for Gas-Burners.—Boardman, F. R., of Tottenham Court Road. No. 17,958; Aug. 13, 1896.

The patentee proposes to use two separately operated solenoids or magnets, each energized by an electric current when passing through its special circuit (separately operated by connection with a source of electricity) when it is desired to actuate the gas-controlling valve in either direction. One solenoid when energized is employed to lift its core or attract an armature whereby the valve is opened to admit gas to the burner; while the other is used to reverse the action and close the valve—the first circuit being simultaneously or previously broken.

When the core is attracted to a certain point within the opening solenoid, the gas-valve is opened by a spindle connecting the core and the valve, so that gas passes freely to the burner. The spindle has an enlargement of ball form, adapted, when attracted by the opening solenoid, to press aside springs, and rest thereon with the valve in its opened position When the closing solenoid is energized, the armature is attracted in the opposite direction, which closes the valve, and the gas supply is cut off. This form of enlargement again assists in pressing aside the springs which held the valve spindle in its open position, and the valve drops upon its seat; the weight (in some cases) assisting the attractive action of the closing solenoid in shutting off the supply of gas to the burner.

The form of the burner and means of ignition may be of any convenient description; but in cases where a pilot-light is kept burning by means of a bye-pass around the main gas-passage, these improvements are, it is claimed, of special utility, as the valve or its seat is easily formed with a small cut or indentation, so that a slight flow of gas passes through when the valve is upon its seat—thus supplying the pilot-light as a means of ignition, but becoming merged in the main supply when the electrically controlled valve is fully opened.

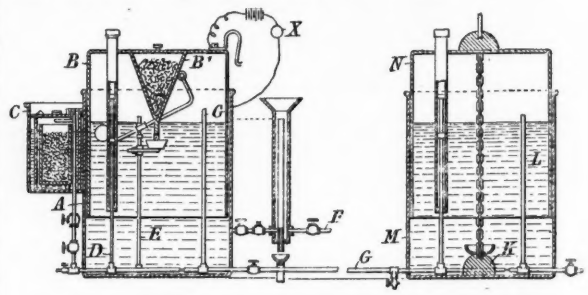
Supporting the Mantles of Incandescent Gas-Burners.—Symons, P., of Swansea. No. 20,358; Sept. 15, 1896.

The object of this invention is to provide means whereby the mantles of incandescent gas-burners can be "firmly and steadily clasped and held in position close to the flame, so as to ensure full incandescence to the bottom of the mantle." The mantle is held between a cylindrical ferrule and expanding cylindrical segments or tongues fitted on the exterior of the ferrule, and shut together around the ferrule, so as to clip the mantle thereto, by means of a band or ring adjusted as desired by a lever, clip, spring, or other similar device.

Generating Acetylene Gas.—Reynolds, D. J., of Winnebago (Min.), U.S.A. No. 29,342; Dec. 21, 1896.

In this apparatus for the production of acetylene from carbide of calcium, two holders are employed—one (the primary holder) to receive the gas from the generator, while the secondary holder receives the gas from the first, and delivers it to the service-system.

The primary holder comprises a fixed cylinder A, with a moveable cover B telescoped therein. The secondary holder comprises a fixed cylinder M, with telescoped cover N. The holder for the carbide is a box or tank C, with telescoped cover, and an inner receptacle for the carbide. Both holder and generator are water-sealed. The cover of the primary holder is weighted by a cone B^1 protruding down within the holder. The generator is fixed in relation to the holder; and a gas-duct D, open above the water-level of the holder, extends out through its bottom, and thence leads to, and opens in, the upper part of the generator. A water-duct E leads from the holder into the generator, discharging therein above the carbide receptacle, having its highest point immediately above the plane of the low-water level of the holder. G is a gas outlet-pipe, which leads either to the secondary holder or to the service-system.



A pipe F, connected with water under pressure sufficient to raise it to low-water level, extends into the holder. The generation of gas being dependent upon the admission of water to the generator by the water-duct E, no gas will be generated unless the water for the purpose is raised above the highest point of the duct, which is the low-water level of the holder; and it is therefore provided that the descent of the cover of the holder A shall elevate water to cause it to pass into the generator. The gas passes from the generator by the gas-duct G into the holder; the cover B continuing to descend and force water over into the generator until the production of gas equals the consumption, when the descent of the cover will cease. The displacer is thus alternately thrust into and withdrawn from the water, whose level is restored through the supply-pipe F as often as the displacer withdraws. As the carbide decreases in strength and responds less and less slowly upon each discharge of water upon it, the range of oscillation of the displacer increases somewhat, and ultimately, the carbide being exhausted, and the receptacle in which it is being nearly full of the residuum dissolved in water, the generation of gas does not overtake the consumption, and the displacer continues to descend and force water over into the generator until the latter is flooded, and all gas therein is driven out through the pipe D into the holder. When this occurs, the holder cover B is at a lower point than it has reached before, and at this point sounds an electric alarm X, warning the attendant to recharge the generator. When, however, the secondary holder is used, this alarm is comparatively unnecessary.

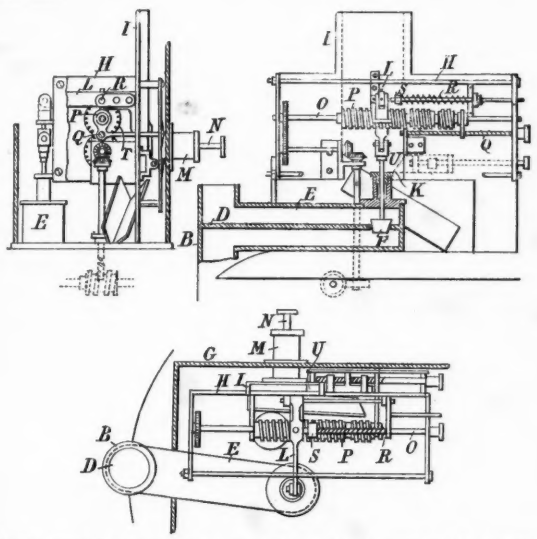
The second holder M, when employed, receives the gas through the pipe G, and delivers it through the service-pipe L. The cover N of the holder is weighted to a less amount than the cover B of the primary holder; but from its under side a chain extends to a weight K, lying on the bottom of the holder. This chain is long enough to permit the cover to rise without lifting the weight to within a few inches of its upper limit of movement; and when it has thus taken up the slack of the chain, the pressure exerted upon the contents of the holder (being the weight of the cover and of the chain, less the buoyancy of the water in which the chain is partly immersed) is slightly less per square inch of gas-surface in the holder M than that exerted in the holder A by its weighted cover B. From this it results that, as the gas passes from the generator first into the primary and then into the secondary holder—both having their covers depressed at the commencement of the operation—the cover of the secondary holder will be lifted first until all the slack of the chain is taken up and enough pull exerted on the weight to make the total pressure equal to that of the primary holder. The primary holder will then fill to some extent; and as gas is withdrawn for consumption, it will pass through the secondary holder without permitting the cover of the latter to descend. In this way the content of the secondary holder remains as a constant reserve supply; the cover of the primary holder rising and falling, and maintaining the generation of gas according to the rate of consumption. When, however, the carbide in the generator becomes weakened so far that the gas supply is not equal to the consumption, the cover B is not lifted; but, on the contrary, the cover N is—the secondary holder being thus fed into the service-pipes.

Connected with the cover of the secondary holder is an alarm-device, consisting of a rod extending upward, and having a trip dog or other means of sounding an alarm after the cover has descended a very short distance—say, 2 or 3 inches. The sounding of this alarm gives notice of the failure of the generator; and the attendant has opportunity to replenish the latter, while consumption is supplied from the reserve gas in the secondary holder as the cover descends, and deposits first the weight and then the slack chain. The pressure being diminished, the cover of the primary holder will descend farther than at any time during its ordinary oscillation while the generator was active, and in such final

descent will cause the displacer to be intruded into the water deeply enough to flood the generator, as already described.

Prepayment Attachments for Meters.—The California Prepayment Meter Company and H. W. Williams, of California, San Francisco. No. 1429; Jan. 19, 1897.

An end view, rear elevation, and top view of this attachment for a dry gas-meter are shown in the engraving. B is the inlet to the meter, and C the outlet connection. In the inlet is inserted a stop or barrier D, which extends outwardly, and divides a short casing E into two passages, the former of which communicates with the inlet above the stop, and the latter with the inlet below the stop. The passages communicate at their other ends through a port controlled by a valve F. On top of the meter is a casing G, having a slot in its top for the insertion of a coin, a door in its front for the inspection of the adjustment indicators, and a slide or door in its end for the removal of the deposited coins. Within the casing is a frame H, which supports a coin-shoot I, the upper end of which aligns with the coin-slot in the casing. The lower end communicates with a directing shoot to pass the coin down into the bottom of the casing. In the inner side of the shoot, at its lower end, is a swinging plate K, secured to the short arm of an elbow lever L, which is itself fixed at its angle to a pivotal shaft. The lever has its outer end connected with the stem of the valve F. On the face of the shoot is secured a sleeve or housing M, which extends outwardly through the casing. Within this housing slides a push-rod N, having a head upon its outer end, and controlled by a spring, whereby it is held projected outwardly. The inner end of the rod is adapted to traverse the lower end of the coin-shoot, and, if no coin intervenes, to pass through a hole in the plate K; so that when the coin is absent, if the rod be forced in, it has no effect upon the swinging plate, as it passes freely into the hole in the plate. But by the interposition of a coin within the shoot, the rod will, by coming in contact with the coin, force it to swing the plate K, which movement will, through the elbow lever L, cause the valve F to rise and open the communicating port of the meter. When the rod is released, its spring will throw it out again, and the coin will drop down into the casing. Meanwhile, the swinging plate will return to its closed position under the weight of the parts; and the valve F will automatically close and cut off communication with the meter.



In the frame H is mounted a rotatable shaft O, upon which is fitted a screw P, so arranged that it will rotate with the shaft, and may also have an independent sliding movement lengthwise upon the shaft, which latter movement is effected by means of a feed-screw Q, engaging a nut which engages one end of the screw. The shaft O is driven from the operating parts of the meter itself (not shown).

Secured upon one end of the pivotal shaft is an outwardly extending arm, between the extremity of which and the long arm of the elbow lever L extends a guide rod or bar R, upon which slides a sleeve S, which has a downwardly extending finger adapted to play in the groove between the threads of the screw P below. The depth of the groove is such that, when the finger rests in it, the lever L is held up and the valve F is kept open; but the groove at its extremity terminates in a depression deep enough that, when the finger emerges into it, the lever L drops and the valve F closes. A spring tends to throw the sleeve S over against the long arm of the elbow lever L.

Extending outwardly from the nut which engages with the feed-screw Q is an arm T guided in a slot in the front of the frame H, and having on its outer end an indicator which plays over a dial adapted to be seen through the door in the casing. By operating the feed-screw Q, so as to slide the screw P along the shaft O, the indicator will also move correspondingly to the figures representing the value of the coin for which the machine is to be adjusted. This movement of the screw will also, by the impingement of its end thread upon the finger of the sliding-sleeve S, bodily force the finger along the guide-rod R, and thus compress the controlling spring. This movement of the finger will be equivalent in distance to the movement of the indicator on the dial.

When ready for operation, a coin is dropped into the shoot I; and by means of the push-rod N, the swinging plate K is forced inwardly through the intervention of the coin, so as to lift the elbow lever L and open the valve F. This rise of the lever L will cause the rise of the guide-rod R which is secured to it, and the consequent lifting of the finger from behind the end thread of the screw P. As soon as the finger is free, the spring will force the sliding-sleeve S over to its limit against the elbow lever L, and thereby cause the finger to move over, and free of, the top of the screw to a distance equal to that to which it had been forced sideways, as the screw was moved along to its initial adjustment. As soon as the coin is dropped from the shoot, the plate K and the elbow lever L return partially; but the screw groove is not deep enough to allow the finger to come far enough down to permit the valve F to close entirely, so that it is still open, and remains so as long as the finger is in engagement between the threads of the screw. As the valve F is now open, and the meter starts to operate, the shaft O is revolved, and with it the screw, which now begins to feed the finger out again to its initial position. During this feed, and the operation of the screw, and as long as the finger remains in engagement between the threads of the screw, the valve F is held open, and gas passes through the meter. But when the finger reaches the end of the thread groove, it drops out into the depression at the end, thereby allowing the valve to descend, and cut off the connection; and at this time the value of the gas equals the value of the coin. The finger is now in a pressed-over position, ready to return to its engagement with the screw, when—upon the deposit of a coin—the operation is repeated.

In order that warning may be given previous to the expiration of the prepaid supply, it is provided that the extremity of the screw-thread groove shall gradually deepen on a descending inclined plane, whereby, as the finger gets into this gradually deepening portion of the groove, the elbow lever L will be permitted to move down slowly; and by making the valve F conical in shape, it will gradually cut off the port, until the finger gets entirely out of the groove, when the port will be fully cut off.

In order to adapt the attachment for different sizes of coins and different prices per 1000 cubic feet at which the gas may be supplied, the base of the shoot I traverses a rest-bar U, formed with a slide body adapted to be fed by means of a feed-screw. The body has extending outwardly from it an arm carrying an indicator playing over the dial, which has upon it scale figures representing different sizes of coin. By turning the feed-screw so as to cause the slide body to move inwardly, the rest-bar U is moved into the shoot far enough to diminish its width, so that the former size of coin will be supported within the shoot temporarily, and until the push bar or rod can engage it, and force it over against the swinging plate K.

Burners for Incandescence Gas Lighting.—Léry, J. B. de, of New York. No. 7921; March 27, 1897.

This invention relates mainly to the manner of grouping incandescent gas-burners, whereby it is said that (*a*) much of the loss heretofore experienced in the destruction of the mantles is avoided; (*b*) the renewal of mantles may be easily accomplished; (*c*) any member of a group of burners to which the gas supply is controlled by a single valve may be operated while the remainder are out of use; (*d*) equal gas pressure to each burner of a group is ensured; and (*e*) it is possible to group a certain number of burners into the smallest and most compact space.

Acetylene Gas Burner.—Lebeau, J., of Châtelineau, Belgium. No. 9719; April 15, 1897.

This burner for acetylene gas consists of a block of suitable (steatite) material, provided with gas outlet-passages inclined towards one another at a suitable angle, and with air-passages arranged parallel to the gas outlet-passages, for the purpose of ensuring a regular supply of air to the flame. The air-passages are formed in shoulders on the body of the burner, so as to screen the flame from outside air currents. There is also provided, by the hollow burner-body, a small gas-chamber, to compensate for momentary slight variations in pressure.

APPLICATIONS FOR LETTERS PATENT.

16,526.—Fletcher, E. L., Russell, W., and Fletcher, Russell, and Co., Ltd., "Gas, oil, and similar stoves." July 13.
16,605.—Beal, W., "Incandescent gas-lights." July 13.
16,613.—Askham, W., "Gas-engines." July 13.
16,631.—Russ, J. D., "Gas-engines." July 13.
16,686.—Forrester, S., "Gas-engines." July 14.
16,706.—Fitzmaurice, L. G., "Internal combustion engines." July 14.
16,727.—Schroedter, P., "Incandescent gas-burner." July 14.
16,738.—Edwards, E. J., "Acetylene lamps." July 15.
16,752.—Naylor, S., Steel, R., and Jefferson, J. C., "Gas-engines." July 15.
16,765.—Lühne, J., "Meter for water, steam, air, and the like." July 15.
16,793.—Sigurdsson, O. V., "Manufacture of acetylene gas." July 15.
16,862.—Mueller, H., "Glass rod chimney fitted with metal springs." July 16.
16,890.—Whiteley, R. H., and Ellis, W., "Enriching coal gas." July 16.
16,975.—Marks, G. C., "Generation of acetylene gas." A communication from A. F. Bowers. July 17.

Inauguration of the Loanda Gas-Works.—The Loanda Gas Company, Limited, have received advice by cable that the gas-works recently constructed in the city of Loanda, on the west coast of Africa, were inaugurated with great display on the 18th inst. Their success was complete, and the public satisfaction is very great. The proceedings terminated with a ball.

Goole Gas and Water Supply.—The accounts of the gas and water undertakings of the Goole District Council for the past financial year show a net profit of £4019. In the three months which have since elapsed, there has been realized a net profit of £1096 on gas and £456 on water. After payment of the principal and interest, as well as other charges, there remains a net balance amounting to £4583.

Automatic Gas-Meters in Montreal.—Following the extended use of automatic prepayment gas-meters abroad, the Montreal Gas Company have contracted for 2000 of these meters, which are being put in service in the city. They are operated by the insertion of a Canadian 25-cent piece, and no other coin. It is arranged, however, that as many as 16 pieces can be put in at once. The 1288 slot meters now in use in Montreal are set both for illuminating and fuel gas services; and the latter is sold at $1·05 per 1000 cubic feet, which is computed to bring the cost of operating an ordinary gas-stove for family use to about $2 a month.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Accident Fund of the South Metropolitan Gas Company.

SIR,—Reading the abstract of the rules of our accident fund in this week's "JOURNAL," I was struck with the apparent absurdity of giving 12s. a week to a man whose injury is caused by his "own gross negligence." Of course, in such a case, in strict justice, no allowance should be given; this being the principle adopted in the new Act. I therefore feel it necessary to explain why we have acted differently.

We have other funds—one being for relief when incapacitated by sickness or accident however caused, even by the man's own negligence. It is provided by the accident fund rules that the sick fund shall pay nothing for accidents; therefore, in order that the men should not be worse off, it was necessary to give the same allowance as they would have received under the old *régime*. It is a small matter. There will be very few such cases; and when they do occur it will be a valuable point gained to get a jury of fellow-workmen to bring in a verdict of gross negligence. This I believe they will do. But if there were no allowance in these cases, the sympathies of the jury for the innocent victims—the wife and children of the culprit—would tend powerfully to warp their judgment. It will be far more important to get the condemnation of his fellow-workmen where there has been gross negligence than to save 12s. a week for a time.

Running through all these provisions and regulations is the object of making the workmen feel their responsibility, in order to secure their active co-operation in the prevention of accidents.

GEORGE LIVESEY.

South Metropolitan Gas Company,
Old Kent Road, S.E., July 22, 1897.

The Price of Gas Coke.

SIR,—In the Liverpool Town Council last month, the question was asked as to whether the Council had not the power to compel the Gas Company to sell coke in Liverpool at the same price they were selling it at beyond the city. It is the price at which coke is sold in the outside districts that causes it to be so cheap. If all makers of gas coke in this country were to resolve not to sell any either within or beyond their districts, at a lower figure than 8s. 4d. per ton at the works, it would be considered a fair charge, and it would be paid without the least demur. This is the price at which it is now sold at Birkenhead and at the Wallasey Gas-Works.

J. M.

July 20, 1897.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills reported: Borrowstounness Water Provisional Order Bill. Duntocher and Dalmuir Water Provisional Order Bill, East Warwickshire Water Bill, Leicester Corporation Bill, New River Company Bill, Southwark and Vauxhall Water Bill.

Bills read the third time and passed: Dundee Corporation Bill, East London Water Bill, New River Company Bill, Leeds Corporation Bill, Nottingham Corporation Water Bill, Pwllheli Corporation Bill, Weymouth Water Bill.

A petition against the Salford Corporation Bill has been presented from the Little Hulton Urban District Council; and one against alteration in the Bill, from the Swinton and Pendlebury Urban District Council. The Bill has therefore been referred to a Select Committee, consisting of Lord Rathmore (Chairman), the Earl of Carlisle, Viscount Harding, Lord Braye, and Lord Elphinstone; to meet on Monday, July 26.

HOUSE OF COMMONS.

Monday, July 19.

TRADE UNIONISM AND BRITISH TRADE.

Mr. HOGAN asked the Under-Secretary of State for Foreign Affairs whether he had observed, in the recently-published annual report of Consul Leefe on the subject of the trade of Tonga, that the British workman was described as being "misled by self-interested agitators," who made their living out of him, that strikes were declared to be the offspring of Trade Unions, and that the latter organizations were said to produce a tyranny which resulted in the honest, hard-working man being placed on an equality with scamps and loafers; and whether it was part of the recognized official duty of a British Consul to embody such private political speculations in such uncompromising language in his annual report to the Foreign Office.

Mr. CURZON: I have not detected any "private political speculations" in the report in question. On the contrary, the Vice-Consul, who wrote it in pursuance of the duty imposed upon him to point out any circumstances calculated to act prejudicially to British trade abroad, expressed what I have no doubt was an impartial and honest opinion, which he also supported by a local illustration. It is not proposed to discourage consular officers from such an expression of their views.

Tuesday, July 20.

METROPOLITAN WATER COMPANIES BILL.

The consideration of this Bill in Committee was resumed on clause 2, which stood as follows:—

A local authority may aid any water consumer in obtaining the determination of any question which appears to the local authority to be of interest to water consumers with respect to the rights, duties, and liabilities of any of the Metropolitan Water Companies, or otherwise with respect to the supply of water given and the charges made by the Metropolitan Water Companies; and may take such legal proceedings as appear to the local authority necessary or expedient for the protection of the interests of water consumers with respect to the matters aforesaid.

Mr. CHAPLIN moved the addition of the following words: "A local authority aiding any legal proceedings under this section may, if the Court think fit, be made a party to the proceedings, and shall be liable for costs accordingly." He explained that the object was to enable local authorities to support private individuals in cases where a water company had disregarded any of their statutory duties.

The clause, as amended, was agreed to, as was also clause 3, which provides for the extension of the Metropolis Water Acts to the whole of the area within which any of the Companies are authorized to supply water.

On clause 4, defining the expressions used in the measure,

Mr. CHAPLIN moved the following proviso: "Nothing in this Act shall affect the terms of any agreement between a Water Company and a water consumer as to the supply of water."

Mr. LOUGH asked for an explanation of the amendment. He said it appeared to him that its effect would be to neutralize some of the advantages which consumers hoped to derive from the measure.

The SOLICITOR-GENERAL said it must be evident to the Committee that it was desirable that any agreements entered into between the Companies and consumers should not be affected by the Act.

Mr. BUXTON thought the amendment might be carried out to such an extent as to reduce the advantages which the Act gave to consumers. He had had many agreements brought under his notice in which the Companies tied the consumers hand and foot in many ways; and he did not think such agreements ought to be exempted from the operations of the Act.

Mr. CHAPLIN said he was afraid he must adhere to the amendment; but he thought hon. members opposite might rest assured that it would not entail any hardships on consumers.

Mr. STUART said that, in his opinion, the operation of the measure, limited as it was in its present form, would be still more restricted if the new clause were adopted.

Mr. BANBURY said he understood the clause was to apply only to agreements for the supply of water to farms, hotels, and hospitals. If a consumer thought that by continuing an agreement he would be deprived of any advantages given by the Bill, he could terminate it.

Mr. BOULNOIS said that, so far as the Water Companies were concerned, they would not object to the insertion of words limiting the clause to existing agreements. It only applied to agreements with large corporations, hotels, and hospitals; and unless it was inserted in the Bill, such agreements might be disturbed. He moved, as an amendment to the clause, to insert after "agreement" the words "existing at the time of the passing of this Act."

This was agreed to.

After some further discussion, the Committee divided, and there voted: For the amendment, 196; against it, 104—majority, 92. The clause as amended was agreed to.

On clause 5, which set forth that the Act might be cited as the Metropolis Water Act, 1897, and that it was to come into operation on the 1st day of November next after it was passed,

Mr. BUXTON moved an amendment to limit the operation of the Bill till the 1st day of November, 1899.

Mr. CHAPLIN said he was convinced that the effect of the Bill would be by no means small; and in these circumstances he could not for the life of him see why they should tie their hands by accepting such an amendment as the one proposed. If the Bill was to do good, as he believed it would, why should they put an end to its existence in 1899, when no human being could possibly foretell what was going to happen? At the same time, the Government withdrew from no pledge they had given with regard to the water supply of the Metropolis.

Mr. LOUGH supported the appeal of the right hon. gentleman.

Mr. BUXTON asked leave to withdraw the amendment.

Mr. FLYNN objected to its withdrawal. He said he did not believe that the cause of the water supply of London was advanced by the pusillanimous tactics of so-called Radicals who came from certain districts of London. Compared with Cork, the water supply of London was a disgrace.

After some further remarks, the amendment was lost by 204 votes to 96; and the clause was agreed to.

Mr. HOLLAND then moved a new clause as follows:—

When in any quarter in which, owing to insufficiency of supply or pressure, fracture of mains, or any other cause than the default of the water consumer, water shall not have been supplied to any premises on every day in accordance with the law, the owner or occupier of such premises may complain to the Railway and Canal Commission that such deficiency of supply has occurred; and the Commission, if satisfied that the complaint is well founded, may order the Company to repay to the water consumer the proportionate part of the quarter's water-rate paid for the days on which the supply was insufficient.

He said the new clause was consonant with the scope and purpose of the Bill, and was so reasonable an extension of it that he trusted the Government would be able to give it favourable consideration. In his judgment, the general principle of the clause could not be objected to. In no other legal relation in life had a man to pay when the consideration failed; and in the ordinary sense it would be absurd to suggest that a man should pay for what he did not receive. But it was argued that the relationship between the water consumers and the Companies was a peculiar one; that it had been set up by Parliament, and ought not to be disturbed to the detriment of the Companies without compensation, because it was on this basis that people had invested their money in the water undertakings. It should be borne in mind, however, that Parliament had allowed the supply of water to the Metropolitan area to drift into a monopoly, the existence of which threw a great responsibility on the Legislature; and Parliament had never hesitated to vary the terms of any monopoly which had received its sanction when any of the terms appeared to be onerous, or contrary to the public good. The charges of Water Companies were altered from time to time as a condition of further powers; and on this question there could be no distinction between a Private and a Public Bill. The only point they had to consider, then, was whether it was a fair and just condition to impose on the consumer that he should pay for what he did not receive. The provision he was suggesting would be of considerable utility, for it would safeguard the consumers' position and stimulate the Companies to take every precaution to ensure a regular and full

supply. Having dwelt at some length on the inconveniences arising to consumers through a deficient supply of water, whether owing to drought, frost, or accident, the hon. member said his argument was shortly this: That Parliament, when it sanctioned a monopoly, preserved the right of varying and altering the terms in the public interest; that in the case of Water Companies what was practically an absolute monopoly had been created; that it was essential to the health, comfort, and convenience of the people of London that their water supply should be sufficient and adequate; and that the Companies were bound to incur every necessary expense to secure an efficient and constant supply. He submitted that the ordinary sense of justice was against a man being obliged to pay for what he did not get; and, lastly, that the Railway Commissioners should be enabled to make the interests of the Companies identical with their duty. For these reasons, he hoped the Government might be able to look with favour on his amendment. He should like to add that he believed most sincerely that, if the Companies were desirous of maintaining their present position, they would be very unwise if they did not agree to make concessions such as would remove a great cause of irritation and sense of injustice. The time must come when the terms of control or of purchase would have to be settled by the House; and he should imagine, for the sake of their own shareholders, that the Companies would be well advised to meet the consumers half way, and endeavour to secure their goodwill.

Mr. CHAPLIN remarked that the Government did not by the Bill intend to alter the existing law or to increase the obligations of the Water Companies. It would be inadvisable for them to enter upon any such course at the present moment, when a Royal Commission had been recently appointed, and was even now inquiring into all these questions. The new clause, he might point out, would make a great alteration in the position of the Companies. No notice of such a change had been given to them; they had not been afforded any opportunity of being heard on the point, and of urging objections to the proposal. To accept the clause would be to depart altogether from the principle of the Bill as introduced. There were many occasions when a deficiency in the supply was due to causes over which the Companies had really no control, and for which they were not to be blamed. There was, for example, the case of prolonged frost or drought; and mains were sometimes injured seriously by the traffic—the Company being blameless. Yet in this clause no account was taken of these things.

Mr. HOLLAND: Yes, for a discretion is given to the Commissioners.

Mr. CHAPLIN agreed that the word "may" in the clause might be held to give some discretion to the Commissioners; but he doubted whether the Water Companies would consider the question to be thereby satisfactorily settled. Cases in which pipes and mains were injured by frost owing to their being laid at an insufficient depth would, he believed, come within the purview of the Commissioners' powers. There would be great practical difficulties in the way of carrying out the provisions of the clause. It would, for instance, be very difficult to determine in many cases what proportionate part of the water-rate represented the days—only two or three, perhaps—during which water had not been supplied. It must be remembered that in the case of small tenements the whole water-rate for the year did not amount to more than 6s. or 7s. When the Royal Commission should have reported, he had no doubt it would be found that there were a great number of questions concerning the water supply which deserved and required the fullest consideration. But, as far as he knew, there was no reason why they should select the particular question raised in this amendment for legislation on the present occasion. His hon. friend had expressed the opinion that the time would undoubtedly come when the question of purchase must be considered and decided by Parliament. He would remind him that the Government had never pledged themselves to a policy of purchase. This was a matter upon which they had reserved their judgment; and the question whether it would or would not be advantageous to adopt a policy of purchase in the interests of the ratepayers had been specifically referred to the Royal Commission. He mentioned this because he did not wish it to be supposed that he assented to the views expressed by the hon. member.

Mr. BUXTON pointed out that if the clause were introduced into the Bill the position of the consumer would be greatly improved. In cases where a Company were not to blame for the deficiency in the supply, it was not just that the whole of the loss and inconvenience caused thereby should be borne by the consumer.

Mr. BOULNOIS said the Committee had no idea of the enormous wilful waste of water on the part of consumers in the Metropolis, notwithstanding all the efforts of the Companies to prevent it; and if the latter were protected against this waste, they might be disposed to make concessions in the way indicated by the amendment. But they had assented to the second reading of the Bill on the distinct understanding given at the time that their rights would not be disturbed; and if they had not believed that this would be adhered to, they could have prevented the measure from being introduced as a Public Bill.

Mr. BANBURY resisted the amendment.

Sir J. SAVORY protested against the attacks which had been made on the Water Companies, so far as the New River Company were included therein.

Mr. STUART admitted that the New River Company satisfactorily fulfilled their obligations; but this fact, he said, only lent additional point to the necessity for some such clause as this. He could not see why the matter was to be postponed until the Royal Commission had reported on the question whether or not purchase was the proper thing. What had this to do with the propriety or otherwise of people paying for what they did not receive? The clause would not injure any Company who were acting properly; and, on the other hand, it would entail a fine upon those who were acting improperly, or whose plant was inadequate.

Major H. F. BOWLES remarked that one point appeared to have been overlooked. There were water companies in other parts of England, and, though the consumers might not be supplied with water on occasions of drought or burst pipes, they had nevertheless to pay their rates when the demand-notes were sent in.

After some further remarks, the second reading of the clause was negatived by 134 votes to 75.

Mr. BUXTON then moved that a clause providing for the yearly return to Parliament of all actions taken before the Railway and Canal Commission under the Act should be read a second time.

This was agreed to, and the Bill passed through Committee.

DEFICIENT WATER SUPPLY IN BERMONDSEY.

Mr. MACDONA desired to ask the President of the Local Government Board a question of which he had given private notice—whether he was aware that some of the residents in Bermondsey had on the 13th, 14th, and 15th inst. been without a supply of water from the Southwark and Vauxhall Water Company for household, sanitary, and factory purposes; whether the local Vestry had any power in the matter, so as to compel the Company to provide a continuous supply; and, if not, whether he would introduce a new clause to this effect in the Bill now before the House.

Mr. CHAPLIN: I have communicated with the Company; and from their reply it appears that there were five or six isolated cases of complaint on the 13th, 14th, and 15th inst. I shall be happy to show my hon. friend the statement I have received from the Company. As regards the particular case with respect to which a letter was forwarded to me by my hon. friend, I may state that I am informed that the cause of the trouble originated from some person, not in the service of the Company, having shut the private stopcock supplying their premises. No new clause such as that suggested by the hon. member will be required, in my opinion, in the Bill now before the House, for the object he has in view. If the Bill is passed in its present form, it will give full powers to the Vestry to institute proceedings against the Company in precisely such a case as this, if they are of opinion that there has been a failure on the part of the Company to comply with the statutory requirements.

The following further progress has been made with Bills:—

Bills read a second time and committed: Gravesend and Milton Water Bill, Rhymney Valley Gas and Water Bill.

Bills reported: Fylde Water (Transfer) Bill, Gas Orders Confirmation Bills (Nos. 1 and 2), Swansea Improvements and Tramways Bill, Water Orders Confirmation Bill.

Bills read the third time and passed: Belfast Water Bill, Gas Orders Confirmation Bills (Nos. 1 and 2), Water Orders Confirmation Bill.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, July 19.

(*Before Mr. Justice* WILLS.)

The Sunlight Incandescent Gas-Lamp Company, Limited, v. The Incandescent Gas-Light Company, Limited.

This was an action brought by the plaintiffs against the defendants for infringing certain letters patent granted to Messrs. F. L. and W. S. Rawson for the stiffening of mantles of incandescent gas-burners.

Mr. BOUSFIELD, Q.C., Mr. ROGER WALLACE, Q.C., and Mr. JENKINS, Q.C., appeared for the plaintiffs; Mr. MOULTON, Q.C., Mr. TERRELL, Q.C., and Mr. WALTER represented the defendants.

Mr. BOUSFIELD, in opening the case, said this was an action for infringement of letters patent relating to improvements in materials for incandescent gas lighting. His Lordship might recollect the two cases which were tried some twelve months ago, in which he was thoroughly instructed in the art of making mantles for incandescent gas lighting; but he was glad to say the scientific points raised by the specification in this case were of a very simple character, and would not, he thought, give any trouble. His Lordship would remember that the first point of any significance in the history was Welsbach's patent of 1885. After that, and another one which closely followed it, Dr. Welsbach was engaged in pushing his invention in this country, and trying to make it a commercial success. This was first done through the medium of a partnership of Mr. Williams, whose name would crop up in this case, for, in fact, he was now alleged by the defendants to be the first and true originator of the plaintiffs' invention.

Justice WILLS asked if this was the same Mr. Williams whom they heard of in the previous case—the universal patentee.

Mr. BOUSFIELD said no; it was not Mr. Stokes Williams. First there was a private partnership between Dr. Welsbach and Mr. Williams, who in 1885 and 1886 were endeavouring to introduce the invention in this country; but they met with very great difficulties. However, a Company was started which was called the Welsbach Incandescent Gas-Light Company—a predecessor of the present defendants. In 1886, this Company, of which Mr. Frederick Williams was Managing-Director, were endeavouring to push the invention. But one of the great difficulties in their way was that of transporting the mantles; and, in fact, to start them they had to send people out to the houses where the mantles were to be used, which, of course, was not a very satisfactory basis for a commercial undertaking. In the year 1886, the Welsbach Incandescent Gas-Light Company entered into an agreement with Messrs. Woodhouse and Rawson, under which the latter were to experiment with a view to improving the methods of manufacture, and were to have certain rights, including that of taking out patents for such improvements. But the Welsbach Company were to be entitled to use them on paying royalties. Messrs. Rawson were the patentees; but subsequently the firm went into liquidation, and the present plaintiffs had acquired their rights. Working under their agreement, Messrs. Rawson directed themselves particularly to the point to which this patent related—viz., how the mantles might be strengthened, so as to render them more portable. Everyone knew now-a-days how this might be done. The invention seemed of a very simple character; and, though he did not think his friends suggested that it was not subject matter, they said that it was anticipated. These mantles, having been burnt off, were dipped in a solution which set so as to make them more or less elastic and capable of being handled, instead of being friable. When placed on the burner and lit with a match, the stuff into which they were dipped burnt off quickly, and left the friable deposit in its place ready to be acted upon by the gas-flame. This seemed an obvious idea; but Dr. Welsbach and others had been a long while on the subject before they arrived at a

solution. There was a patent taken out about the time for supporting the mantles in glass tubes mounted in gimbals, so that they might be kept in a perpendicular position while being transported; and Dr. Welsbach himself, in various patents, suggested a number of ways of strengthening the mantles—different methods of manufacture which were to be used, introducing stronger threads, making them of two or three thicknesses in the weak places, &c. He merely mentioned this to show that various methods were being tried with the object of producing a mantle which when burnt off should be portable. The invention of Mr. Rawson, as described in his specification, was to dip the mantles after ignition in a liquid which would penetrate the pores and afterwards set to such a degree of hardness as to protect the mantles, which could afterwards be removed without leaving any objectionable residue; and he went on to state that, in working, it was found that paraffin, or solution of paraffin, in hydrocarbons, was the best method of effecting this. There were two claims—one the broad claim of dipping the mantles into a liquid which should thoroughly penetrate it, and afterwards set; and the other, a narrower claim for dipping the mantle in the paraffin. The defendants did not use paraffin, but collodion. His contention, however, was that this exactly answered the description—a liquid which would thoroughly penetrate the pores of the material, and which would afterwards set to such a degree of hardness as to protect the material from any danger of breakage in packing or handling, and which could afterwards be removed without leaving any objectionable residue. The defence raised was, first, that the plaintiffs were not the proprietors of the patent.

Mr. Moulton remarked that they did not insist on that.

Mr. Bousfield said the second defence was that the letters patent were the property of the defendants. This, he understood, would turn upon the agreement to which he had referrred, or the subsequent agreement cancelling it in January, 1887. There was also the defence of non-infringement, and that the plaintiffs were not the first and true inventors. He understood that, in answer to interrogatories, they set up that Frederick Williams was the first and true inventor; and also that the invention was not new, that it was not subject matter, not useful, and that there was a difference between the provisional and the complete specification. Then the last paragraph set out a matter which was a great misfortune to the plaintiffs—viz., that the stamp duty due on Sept. 1, 1896, was left unpaid, and the period had passed during which payment could be made; so that from that date the patent had expired. Of course, this could not affect the claim to royalties on the very large number of mantles which had been made. He put it as a question of royalties, because the defendants had a right under the agreement to use this patent on payment of a 10 per cent. royalty. The claim for damages or an account would cover the back period prior to 1896, including the three very prosperous years 1893 to 1896. After this trial, the Company would have to take other proceedings—not in a Court of Law—to make such an attempt as they could to remedy the mistake which had been made. But as far as his Lordship was concerned, of course it must be treated as an action for recovering damages or profits in respect to what might be due up to the date when the patent expired. The learned Counsel then went through the agreement, reading most of the clauses. He understood it was contended that, under the agreement and the cancellation in 1887, the patents which had been applied for in September, 1886, became the property of the defendants. It was a most remarkable contention; and he could not attempt to deal with it, until he heard how it was put. It was a curious thing that the defendants should only have raised it so recently as when the defence was put in.

Mr. Moulton remarked that this was not the substance of the case. He would not say it was quite immaterial; but certainly it was not the principal defence.

Mr. Bousfield said there were certain issues of fact raised; and therefore he had thought it necessary to give his Lordship some account of the agreement, and to show the position of the parties at the time that the patent was taken out. The anticipations were not many or serious. It was alleged to be anticipated by stiffening the wicks of candles with paraffin, and other things of that kind, which he should not treat seriously until he found that his learned friend stated them seriously. He then compared the provisional with the complete specification; and submitted that there was no want of conformity. The claims were: First, the treatment of mantles after ignition, by immersion in a liquid which would afterwards set, and would burn away without prejudicial result to the mantles, for the purposes set forth. Secondly, the use of paraffin substantially as described, and the treatment named under the first claim. There were therefore two claims—one broad claim, which covered all the patentee discovered; and the second claim in which the particular method of carrying it out which they had found to be the best was discussed. With reference to this, they said they had found the best method to consist of dipping the cone into a hot volatile solution of hydrocarbons, mixed with paraffin wax or paraffin alone. This might not be quite clear at first sight, because paraffin was soluble in volatile hydrocarbons. But the phrase "a solution of volatile hydrocarbons mixed with paraffin wax" was used for this reason: If paraffin was dissolved in benzene, one of the commonest volatile hydrocarbons, the two could be mixed in practically any proportion. A quart of melted paraffin might be put into a spoonful of benzene; and when mixed it would be practically paraffin. On the other hand, a quart of benzene might be put into a spoonful of paraffin, and one would hardly know there was any paraffin there—there would be a clear solution with a small quantity of paraffin in the benzene. Intermediate between the two, there might be any proportion of benzene and paraffin. As a matter of fact, the friability of the mantles depended very much upon what they were made of. Some of them could hardly be looked at without their going to pieces; whereas others would stand a certain amount of handling. His Lordship would remember that in the former case they showed mantles made of nearly pure alumina, which could be almost thrown about. In order to avoid any question of what particular mantle they had experimented with, which would involve inquiries into the constitution of the material, they had produced specimens made by the defendants themselves. They had simply bought a number of the genuine Welsbach mantles from the defendants, which they had burnt off, and then dipped in the materials described by the patentees. He handed one up dipped in a solution of paraffin in benzol, which his Lordship handled. He then burnt off another mantle, and handed it up without any further treatment; and, of course, it dropped to pieces at the first touch. His contention was that, within wider limits, it did not much matter what was used. Starch might almost be employed; and perhaps his friend might next suggest that the process of starching was an anticipation. A solution of dextrine in water certainly would be perfectly serviceable. One might take shellac, india-rubber, beeswax, spermacetti, and a large number of things of that sort if dissolved in volatile hydrocarbons—such as benzene, benzol, benzoline, or acetone, for there was also a wide range of solvents. Practically, what had turned out to be the best, and what both the plaintiffs and defendants used, was the ordinary collodion of the British Pharmacopœia, known as surgical collodion. He understood it would be suggested that it required further invention to get at collodion; but that he thought would be of very little value as a plea in the present action. They tried it in the former case with regard to the present defendants' incandescent mantles, but with very little success. Of course, all subsequent things were improvements on the first; but the invention was all comprised in the few lines which he had read from the specification—dipping the mantles into a liquid which would set hard at ordinary temperatures, and so on. People might experiment and find that paraffin could be employed, and that the addition of a certain kind of carbon would do better; but that was simply improving on the invention of the patentee. As to the question of the first and true inventor, he should leave this for his learned friend to make out.

The following evidence was then called for the plaintiffs.

Dr. *Otto Hehner* said he had read Rawson's specification. It was perfectly clear; and the process described for stiffening mantles was new, as far as he was aware, at that date. The mixture described in the defendants' answers to interrogatories was what was commonly called flexible collodion; and in his opinion it came within the process described in the specification.

Cross-examined: A mixture of Canada balsam and collodion was called flexible collodion. The addition of other solvents—such as acetone and absolute alcohol—was practically immaterial. It was a matter of experiment what particular liquid would answer best for this purpose. Collodion succeeded very well up to a certain point. He had made hundreds with collodion alone; but the collodion was apt to evaporate, and made the mantles shrink slightly, so as to prevent putting them on the burner. They could be burned off, and then put on the burner. The specification fully gave general instructions, except as regarded paraffin. The only instances dealt with in the specification were those of hot liquids which solidified on cooling. The stiffening of substances by dipping them in liquids was old in many instances. There was nothing to suggest that starch or paper pulp would do. Anyone accustomed to this kind of work would know what substances might be substituted for paraffin, and what solvents might be used. This was a practical invention for a practical purpose. He had never heard of the mantles being sent about unstiffened, after burning off. It was practically impossible to send out mantles to be burned off on the customer's burners. He had not known of a solution of paraffin being used for this purpose commercially—only experimentally for the purposes of this case; but it would have been perfectly capable of yielding successful results. It was a question of experiment which fluid would be the best. A solution of shellac in alcohol would do; but no doubt a certain amount of experiment and invention would be required. Shrinkage might or might not be fatal. Paper pulp would do; but it was not referred to in any way in the specification. The statement that it must burn away without leaving any prejudicial residue, indicated that the substance must be inflammable, and had no mineral residue. Everything left some residue. Shellac in a suitable solvent would answer; and he should think it came within the claim. The same with an india-rubber solution. It could not have been said absolutely that it would succeed, without experiment to find what was the best strength. Dextrine was not referred to; but he should think it was within the invention. The object of the hot-air bath described was to keep the paraffin in a molten condition until all that was superfluous had run to the bottom, whence it could be removed. Turning to the prior specifications, and taking first Clamond's of 1880, he described the Clamond light briefly, in which a protective casing of cardboard was suggested. In the 1882 patent, a basket of magnesia threads was described, which also had a casing of paper or combustible material put over it, which was burned off *in situ*. He did not think paper pulp was within plaintiffs' specification. It was very different from a solution of dextrine in water. He did not know of Clamond burners being dipped in dextrine to strengthen them. It was not necessary, as they could be sent about very well without.

Re-examined: He had tried paper pulp, but not for the purpose of this case. He saw no connection between Clamond's patent and the present one. His common sense would tell him not to use a solution as thick as treacle; and that one too thin would not have sufficiently protective effect. There would be no difficulty in finding liquids which would answer the purpose indicated and described in the specification. Experiment would only be necessary to find out which answered best, or had the fewest disadvantages. Ether alcohol collodion had the disadvantage that it contracted the mantle, and made it necessary to burn it off before putting it on the burner. The Canada balsam referred to in the answer to interrogatories, was well known as a material which did not readily harden, and made the collodion into which it was put flexible. In 1886, the use of incandescent mantles was in only an experimental stage. The adoption of a hot-air bath expedited the process; it hastened the evaporation of the solvent. A 50 per cent. solution of paraffin in benzene would be fluid at about 90° Fahr. A 40 per cent. solution would be fluid at a still lower temperature. That was only necessary to ensure fluidity.

Sir *William Crookes*, F.R.S., said he had read the specification, and tried experiments with the materials mentioned therein. Mantles could be protected with paraffin; but "other materials" were clearly mentioned. The description given of the materials to be used would be perfectly intelligible to any person likely to deal with it. He would know that a certain number of substances would answer; others he might have some doubt about, until he had experimented. Collodion would certainly suggest itself. Captain Abney, in a book published in 1876, referred to the "setting" of collodion. It was well known that it set at ordinary temperatures; and also that it would burn away without

violence, and leave practically no residue. If it had no castor oil or Canada balsam mixed with it, it would cause the mantle to contract. The obvious remedy would be to make the mantle rather larger to begin with. He had tried paraffin, and found it answered practically as a protective. He had read Clamond's specification, and did not consider it any anticipation of plaintiffs' patent. He certainly considered the method described in defendants' answer to interrogatories came within the specification.

Cross-examined: At the outset, anything which made the mantles portable was a great advantage, as they were then so very friable. He did not know anything about their being sent out unstiffened, and unburnt off. There was no actual mention of anything but paraffin; but there were indications sufficient to tell him what materials could be employed. He would adopt the phrase "any liquid which would succeed," as being a short description of what the patentee said, if his idea were correct that this was a master patent.

Mr. MOULTON then read a passage which he referred to as being in an Austrian patent of April, 1886, of Dr. Welsbach's, in which he spoke of an incinerated mantle being dipped in a solution of india-rubber or collodion, or similar substance, and then slowly dried.

Mr. BOUSFIELD objected that no particulars had been given of any such anticipation; and, as a fact, he was instructed that the passage in question did not appear until 1887.

Mr. MOULTON did not put it forward as an anticipation.

Justice WILLS said he should pay no attention to it from that point of view.

Cross-examination continued: He had no knowledge of the Clamond burner; but looking at the specification, he saw no suggestion of dipping the burner into anything.

Re-examined: The description given was sufficient to suggest to a chemist what materials he should employ. It was a good deal beyond a mere "pious wish." Collodion would suggest itself as one of the first. Surgical collodion, such as could be bought anywhere, would answer perfectly. It could easily be made to fail; but it would require experiment. Ordinary chemical collodion he should slightly dilute, because it was rather too viscous.

Professor *Vivian B. Lewes* said, in his view, the invention described in Rawson's specification was a method of stiffening the incandescent mantles so as to render them safely portable. This invention practically made the success of the incandescent gas-light. He considered the method used by the defendants came within the specification. When the idea was once put before one, a number of liquids which would answer the purpose would suggest themselves to a chemist. Collodion was one such liquid. As far as he knew, it was an absolutely new idea at the time of the patent.

Cross-examined: He did not think the patentee indicated the old collodion, which contracted the mantle. Any liquid which would answer would, in his opinion, be within the patent. The public would have to go to some skilled person to find out what liquid to use. He would not say without experimenting whether boiled linseed oil would answer or not. He remembered Clamond's burner; but he did not know of its being dipped in anything so as to make it stronger. He recollected their coming in paper cases, or in platinum baskets. The case had to be burnt off.

Re-examined: He could easily mention liquids which would not do, and others he should think would do. There would be an intermediate class, which he would not give any decided opinion upon without experiment. The patentee evidently contemplated that the mantle might be burnt off before being placed in position. Ordinary collodion, if too strong, could easily be diluted.

Mr. *W. Stepney Rawson* said he was one of the patentees. He and his brother worked at the subject together. He first thought of the dipping process. It was absolutely new, and his own idea.

Tuesday, July 20.

Mr. *Rawson*, cross-examined, said he and his brother, Mr. Fred Rawson, worked together on this matter to a certain extent. He did not think they conversed together on the particular point now in question until he (witness) showed his brother what he had done. He thought that was at the end of July or beginning of August. He made notes of the experiments, but had lost them. He himself only experimented with paraffin; but his friend, the late Mr. William Donkin, experimented with other things. He showed Mr. Williams what he had done when he came to the works. He thought it was in July or the beginning of August, 1886. He did not remember his brother informing him that Mr. Williams had been to Vienna, and had told him what he had seen there. He did not recollect hearing of shellac being used for stiffening mantles until within the last two years. Mr. Donkin experimented with collodion; he should think it was after the date of the patent. The first time he saw Mr. Williams, he showed him what had been done, as well as the staff at the works; but no one else that he remembered. He told them how the paraffin was used. That was before the date of the patent. He never saw the Directors of the Incandescent Company. He probably showed it to a dozen people or more; no secret was made of it in the works. Mr. Williams frequently came to Woodhouse and Rawson's works. He did not then know any of the other Directors of the then Incandescent Company. They had a certain number of mantles in the place with which they experimented. In December or January, they paraffined a number of mantles, and sent them to the Company. They had great difficulty in making the mantles. They were then manufacturing them for the Company. They stopped making them about February, 1887. They sent out a large number stiffened, and probably some unstiffened. He did not know that mantles so stiffened were not a commercial success—that they froze in winter, and softened in warm weather. He should think it would depend on the paraffin. He did not know anything about what the Incandescent Company did in the way of stiffening mantles. He had no personal knowledge of the operation of collodion. After the patent was obtained, it was assigned to Woodhouse and Rawson. When the Company went into liquidation, he and his brother re-purchased the patent from the Liquidator for £500. It was afterwards sold to the plaintiff Company on July 14, 1895. During the period between 1886 and 1895, he saw the defendant Company's mantles burning in shops; but he did not see them in boxes until 1891 or 1892. He noticed that they were stiffened; but he did not know it was by means of collodion. He could see it was not paraffin. He did not know that it had been done from May, 1887, onwards; but he gathered they must be doing something of the kind, or they could not work. He began using incandescent mantles in Cornwall Gardens in 1886, but afterwards discontinued them. He had a conversation with Mr. Moeller on one occasion, but could not remember saying how the mantles were toughened. Until November, 1895, there was no action, or threat of action, against the defendant Company for infringement of this patent.

Re-examined: The agreement of 1886 provided that the Directors and officers of the Welsbach Company might, at all reasonable times, on giving notice, enter the works and laboratories of Woodhouse and Rawson for the purpose of inspection. They were in the habit of experimenting, and taking out patents. They gave the officials of the Welsbach Company every information. Putting aside Mr. Williams, he did not think anyone divulged what was learnt. The stiffened mantles delivered in November and December, 1886, to the Welsbach Company were sent in fulfilment of orders. In 1893, the Liquidator of Woodhouse and Rawson, on his advice, took out a summons for leave to commence proceedings on the patent. In 1891, he had no personal interest in it.

Mr. BOUSFIELD said that completed his case, subject to calling rebutting evidence to meet any points his friend might make.

Mr. MOULTON said the defendants' case was shortly this: They did not object to the invention in claim 2, or dispute that it might have been the invention of Messrs. Rawson, nor did they care to dispute the novelty or utility of such an invention, though it might fairly be doubted whether it included any subject matter. If that were the only case, they would not be there, for it was of so little utility that it had practically never been used. The case was substantially that, if claim 1 were to be adopted as a broad claim for treating mantles by something which was in a fluid state and afterwards became hard, and so toughening the mantles as to prevent damage in transport, and which substance could be burnt away without injury to the mantle, it had every fault which a patent could possess.

Justice WILLS asked if it did not really resolve itself into a question whether this belonged to the category which had been called "master patents," though he did not like the term. He meant a patent for a new idea, and showing one way in which it could be carried out.

Mr. MOULTON said his first reply would be that it did not belong to this class; and next that, if taken in that broad meaning, it was not novel or useful, because experiment was required to show what would do and what would not, and no sufficient directions were given.

Justice WILLS remarked that that was generally said with regard to patents of this description. When a patentee was entitled to say that he pointed out one way of doing a new thing, and that covered others, it meant such others as might be afterwards discovered.

Mr. MOULTON doubted if any case had ever gone quite that length.

Justice WILLS said he thought it had been decided that such a patent covered all other ways of doing the same thing. It must mean rather more than a mere chemical equivalent, or it would mean nothing.

Mr. MOULTON submitted that, on the fair reading of the specification, that was not the intention of it. The meaning of it was, attaining the object aimed at (which was a well-known object) by means of a certain class of substances, possessing qualities indicated in the specification—viz., of the type of the paraffines. If it were confined to that, defendants had not infringed it; and they were more or less careless about the exact interpretation put upon it. Before dealing with the specification, he would refer to the state of public knowledge on the subject. Nothing was more common than stiffening things by dipping them into fluids, or analogous methods. So long ago as 1848, Bright's patent was taken out for stiffening wicks for argand lamps, by dipping them in melted wax, to make them keep their cylindrical shape in transit; the wax being removed when the wick was put in use, by burning it off. He did not suggest that Bright was thinking of incandescence.

Justice WILLS said he did not think incandescence had anything to do with the question. The mantles were very frail; and a method of preserving them was required. It did not matter what purpose they were intended to serve.

Mr. MOULTON said he only meant that, of course, the material used must be one which would not be incompatible with the subsequent use of the article; and this patent of Bright's was exactly analogous with the present case. He then went on to describe the Clamond burners, which were also strengthened for purposes of transport.

Justice WILLS thought it was hardly worth while spending much time on that anticipation, as it was a good deal further off than Bright's.

Mr. MOULTON remarked that paper had been tried; and it would answer.

Mr. BOUSFIELD stated that if the defendants would use paper, the plaintiffs would not complain.

Mr. MOULTON said paper was not so easily put on as paraffin; but it burnt off much better. The fact was there were various competing methods for achieving the desired result—not one method only; and it would also be shown that Clamond went a step further, and used a solution of dextrine, into which his delicate little baskets were dipped before they were sent to England. He also tried stearine and collodion. There were some other anticipations which he would refer to after dealing with the specification. He should add that, for months previous to this patent, Dr. Welsbach had been experimenting in Austria on different fluids for the preservation of the mantles; so that whatever Mr. Rawson did, it was not the invention of a new idea, but the suggestion of some particular substance which would carry it out practically. He did not put forward these experiments of Dr. Welsbach as an anticipation, because they were carried on abroad. His only wish was to show that the idea was not new—in fact, the specification itself stated that various methods had been proposed for protecting the mantles in transit. If all users of mantles possessed the requisite skill and knowledge, there would be no necessity for such devices, as they could be sent out before burning off, in which condition they were perfectly safe. But many customers being unskilful, breakages were of frequent occurrence; and it was therefore desirable to burn them off first, and then protect them by some subsequent process. If, however, the method devised led to as many mishaps as it saved, it would be practically useless; and this was the difficulty which Dr. Welsbach had, up to the date of his last English patent, failed to solve. Some fluid

which would thoroughly answer the purpose, was therefore a great desideratum; but the idea of preparing such a fluid was by no means new. The particular thing mentioned in the Rawson patent was not even equal to some which Dr. Welsbach had tried: and it had never been used commercially. It would be shown that what Dr. Welsbach had done was communicated to the Rawsons, or one of them, before the date of the patent. The idea (if it ever was patentable) was brought to England, even if it were not known here already, by Mr. Williams. In claim 1, there was no suggestion of a material which would set in any other way except by cooling. Solutions of shellac, india-rubber, and dextrine had all been suggested before; but Mr. Rawson no doubt thought there was something novel in taking a substance which could be rendered fluid by melting, and became hard on cooling. Therefore he suggested the use of a paraffin having a high boiling-point—such as ozokerit—and dipping the mantles in it at a high temperature; and a volatile hydrocarbon was to be mixed with it, to make it more fluid, because volatility and fluidity went together. The hot-air bath described was to keep the paraffin fluid until all that was superfluous had drained off. It did not cause it to set, but kept it soft. Then the specification went on to say that other materials might be employed, so long as they set hard at ordinary temperatures, and burnt away without mechanical destruction of the mantle, and without leaving any residue which would injure its light-giving properties. Lastly, it said that paraffin which could be obtained very pure, was less sticky, and left less residue than any of the others. There was not a word used which did not receive its full interpretation if claim 1 were taken to refer merely to substances which were rendered fluid by heat, and set hard on cooling; nor was there a word which pointed to substances of an entirely different character, such as collodion. If anything of the kind were intended, where were the directions to the public? Some substances would set by evaporation, and others by being treated with some other substance; but no directions, or even hints of anything of the sort, were given. Linseed oil would stiffen a mantle by the oxidation of the surface; and gelatine, again, was probably, next to starch, the thing most commonly used for stiffening. It would stiffen a mantle; but unfortunately when ignited, the mantle fell to pieces. Possibly, with experimental research, it might be possible to adapt it to the purpose; and then it would be said to be within the patent. The same with collodion. A mantle dipped in it shrivelled up and broke to pieces on lighting. It might be said that this was because an improper strength was employed. But there were no directions as to strength, because, referring only to substances which set on cooling, no such directions were required. It would be difficult, if not impossible, to find a collodion which was strong enough to do any good, and yet not so strong as to distort and destroy the fabric. Sir William Crookes said at once, add castor oil to make the collodion more flexible; but how were the public to know either that such an addition would produce flexibility, or that, if it did, this would remedy the defect by preventing contraction? He did not know that even surgical collodion alone would answer. The preparation used by the defendants had only been arrived at after a long series of experiments; and success was only attained when they added Canada balsam, which was one of the stickiest things known, while the patentees recommended paraffin because it was not sticky. The plaintiffs' witnesses had admitted that experiments were necessary in order to find out what would answer practically; and why should the patentee have a lien on the inventions or discoveries of other people, especially when he himself had not discovered anything which was commercially successful? He submitted, therefore, that the patent was either bad altogether, or that it was restricted to something which the defendants had never used.

The following evidence was then given for the defence.

Professor *Dewar* stated that, as a chemist, he should say the invention described was the application of a fusible organic substance to a Welsbach mantle—one which would be solid at ordinary temperatures, to be applied preferably in the most fluid condition by the use of a high boiling-point paraffin. He saw no reference to any other "setting" than that produced by cooling. The use of a high boiling-point hydrocarbon was to produce an easily fusible compound, which should set at ordinary temperatures. He had not experimented on the effect of paraffin on mantles. The function of the hot-air bath, as described, was to ensure that only a small quantity of paraffin should be left on the mantle, to keep it fluid so that it would drain off. In the case of a material which set by evaporation, the use of a hot-air bath would tend to expedite it. With paraffin, it retarded it. Other portions of the description were inconsistent with the idea of setting by evaporation. Everything pointed to something of a waxy nature; and he should never have thought of collodion as being suggested. Shellac, india-rubber, collodion, and gelatine all presented special difficulties of their own; and there was nothing in the specification that gave any clue to how they might be employed successfully. He had superintended some experiments with Mawson's collodion. [Some ordinary mantles were here lit to produce them in an unprotected state, and were then dipped in a 2 per cent. solution of ordinary photographic collodion. One which had been so treated and dried, was produced much shrunken, and a similar one on being ignited at once fell to pieces.] Witness said the cause was the nature of the collodion. Different strengths might produce different results. [Another mantle dipped in May and Baker's collodion also collapsed on ignition in the same way.] It would require considerable experiment to find out how collodion could be utilized. Defendants used a solution consisting of 13 per cent. of nitro cotton, 55 per cent. of Canada balsam, and 31 per cent. of castor oil. He could never have arrived at such a mixture theoretically; it must have required much experiment. He had experimented with a 10 per cent. solution of gelatine. It stiffened reasonably well, but collapsed on lighting. [This was shown.] He had never succeeded with gelatine; but by using glue, he had been fairly successful. The difficulty lay in the burning off—in the character of the combustion, which varied in different organic bodies. He could not say why a certain strength of glue solution should succeed, and a similar strength of gelatine fail. They were very similar bodies.

Cross-examined: He had only tried the two samples of collodion which had been shown. He had not thought of trying surgical collodion. He could not say it would not succeed. It was not entirely novel that experiment was needed when one varied the prescription of a patentee. It was necessary to experiment if the directions were departed from. Collodion set hard at ordinary temperatures by evaporation. The defendants used a hot-air bath to accelerate the evaporation of the solvent. Mawson's collodion could be improved for this purpose, by using a particular strength, weaker than that usually sold. The original Welsbach patent said nothing about a portable mantle. In the 1886 patent, there were several devices mentioned for strengthening the fabric—such as adding stronger threads or platinum wires drawn through in various directions, double weaving, or additional fabrics. In the next patent of August, 1887, collodion was first mentioned as a means of rendering the mantles portable. A very weak solution was stated; but he found a 0·75 solution better than a 0·5 one.

Re-examined: The devices mentioned in the earlier patents were for strengthening the mantle while in use; and they had therefore to be of a refractory character. It was a different thing altogether from the strengthening now in question. Collodion sets quicker at high temperatures than at low ones. There was nothing to suggest to him that surgical collodion would act better than ordinary.

Justice WILLS pointed out that, as surgical collodion had to adapt itself to the body, anyone who had his attention directed to the matter would probably infer that it would not be so liable to shrink.

At the conclusion of Professor Dewar's evidence, the dipped mantles, which had now dried, were ignited, with the same result as the others.

Mr. *Ballantyne* gave evidence as to experiments with collodion, similar to that given by Professor Dewar. No one without experiment could tell what fluids would answer the purpose of the specification. The solution used by the defendants could not have been arrived at by prior knowledge. He agreed with Professor Dewar's evidence.

Cross-examined: It was not clear to him that the patentee had experimented with gelatine or similar substances. He should not gather from his statement that other substances might be employed, which would not cause mechanical destruction of the mantle on combustion.

Re-examined: Collodion would not set at ordinary temperatures, if protected from evaporation.

M. *Charles Clamond*, the inventor of the Clamond system of lighting, said he remembered in 1882 preparing mantles for the purpose of sending them to England. They were forwarded in 1882 and 1883. He sent certain "baskets" to the exhibition at the Crystal Palace in 1882, made of magnesia, as described in the patent. They were dipped in a solution of dextrine, which, on evaporation, left a solid layer on the magnesia threads, which strengthened the basket. When put on the burner and lit, the dextrine burnt away with a smoky flame. M. Golfier was the Manager of his manufactory in 1886. Some mantles prepared with dextrine were sent in that year to England. Various things were tried, including collodion; but dextrine was the best. The mantles dipped in dextrine were brown, with a glazed surface; and they could easily be distinguished from those not dipped. Some were sent to England by hand undipped. He saw M. Servier at the Crystal Palace.

Cross-examined: M. Servier was now dead. He had a special room at the exhibition, lit by witness's burners. He had no specification of his baskets with him. [One was produced by Mr. Moulton.] They were fairly strong, but brittle. The dextrine made a hard coating over them. A flexible coating would not have been suitable for his purpose. He mentioned paper in his patent, and stuck it on with gum or dextrine. The paper in burning broke the basket; and then he adopted dipping them in dextrine.

Re-examined: They were packed in cotton wool, whether dipped or not. The dextrine was not burnt off as part of the public exhibition at the Crystal Palace.

Mr. *Henry Talbot*, Inspector of Lighting to the South Metropolitan Gas Company, said he remembered the exhibition at the Crystal Palace. After it was over, the exhibits were sent to his Company; and he received them. He recollected the Clamond baskets coming. They were brown in colour, and had a glazed appearance. They were in a box with wool. He lit them, and they gave a flame like a bad bunsen burner, which continued only a short time. Then the burner gave a light very similar to an incandescent burner of to-day.

Cross-examined: They were lit before the gas was turned on. He was ordered to do this by Professor Foster, who made the official test.

Re-examined: He could not say what caused the smoky flame.

M. *Turpin* was called to speak to the manufacture of the Clamond burners from 1882 to 1886. Dextrine was used to coat the baskets of magnesia, in order to strengthen them. A very large quantity were so treated. Some thousands came to England.

Mr. *Goodman*, Civil Engineer, of Paris, said he was connected with the Clamond light in 1886. In June of that year, some burners were sent to London. He believed they were treated with dextrine.

Cross-examined: He had never seen any which were not treated with dextrine. He did not see those which were sent to England.

M. *G. Treier*, of Copenhagen, said he was in Paris in May and June, 1886, and saw the last witness with reference to the Clamond light. He brought some lamps with him to London, where he was then in business. His object was to sell the patent. It was shown to various persons in June and July.

Mr. *D. J. Williams* spoke to seeing the Clamond light at the offices of the last witness, in Eastcheap, in June, 1886.

Mr. *W. J. Moore*, traveller in the employ of the defendants, said he assisted Professor Foster in testing the lights at the South Metropolitan Gas Company's works. He saw a Clamond lamp tested. Before the cone was lit, it had a glazed appearance, and was dark in colour. There was a smoky flame when it was first lit. He also saw the Clamond light at the offices of the General Gas Heating and Lighting Company, at Islington. It had the same appearance as that he had seen at the South Metropolitan Company's works.

Cross-examined: His attention was first called to this matter a few weeks ago.

Mr. MOULTON here drew attention to another mantle which had been dipped in surgical collodion, purchased at Apothecaries' Hall. It presented a very shrivelled appearance, and collapsed when ignited.

Mr. *Frederick Williams* said he was formerly in partnership with Dr. Welsbach, in connection with incandescent burners. In 1886, he paid several visits to Dr. Welsbach; but he could not give the dates, as he had no materials with him.

As witness only arrived in England from Carlsbad the previous evening, his evidence was adjourned to the following day.

Mr. *Imray* was then called, and said he agreed with Professor Dewar as to what was meant by the specification in question. He had examined Bright's specification of 1848, and recollected using wicks made in accordance with it.

Cross-examined: A volatile hydrocarbon was one which readily evaporated.

Re-examined: He considered that volatile hydrocarbon was used in order to make the paraffin fusible at a lower temperature.

Mr. *James Swinburne* said he agreed with Professor Dewar's evidence as to the specification. He had tried many experiments. The mixture of volatile hydrocarbon made the paraffin more fusible. There was no trace in the specification of any setting other than that produced by cooling.

Cross-examined: He could not say the exact proportions of paraffin and a volatile carbon which would give a mixture fluid at 80° Fahr. He should think about 20 per cent. of the paraffin might be dissolved in benzene, and leave a clear solution; but he had not made precise experiments. A 10 per cent. solution of paraffin in a light hydrocarbon, would set eventually, by evaporation; leaving solid paraffin on a mantle which had been dipped in it.

Re-examined: There was no reference in the specification to setting by evaporation.

Mr. *Julius Moeller*, Managing-Director of the Incandescent Gas-Light Company, said he had tried experiments with a view to strengthening mantles, using paraffin as described in the patent. It was not commercially successful. It was a very difficult and delicate process, to get only sufficient paraffin on the mantles; and if sent out, they would soften in warm weather, and get brittle in cold. There was also the difficulty that the paraffin melted, ran down, and clogged the burner on igniting it.

Cross-examined: He had had mantles melt in hot weather. That was in 1892, when they were using collodion. He experimented with paraffin in 1892, because Mr. Rawson spoke about his patent; and they heard so much about it, that he thought he would try it. He laid a few on the top shelf of a room in which there were gas-burners, and found they collapsed. He procured ordinary paraffin; he did not use ozokerit. They also tried stearine; and, he thought, beeswax. He was not interested in the American Welsbach Company; but he was on friendly terms with them. He bought Rawson's patent for the American Welsbach Company. That was a different patent to the one now sued on. He was simply an agent, and had never examined the specification. In fact, he advised them not to buy it. He did not know much about the American patent law, nor that the American Welsbach Company were trying to stop the American Sunlight Company using collodion. The Incandescent Gas-Light Company was formed in 1887; and Mr. F. Williams had been connected with it ever since. He (witness) had been associated with it since 1890. Mr. F. Rawson spoke to him about this patent in 1891. He told him then that there was nothing in his patent, and that his Company used another process. He did not discuss the matter with Mr. Williams or with the Directors in 1892. It was talked over in 1895, when Major Jones, one of the Directors, mentioned that Mr. Rawson was rather sore about it, and suggested that they might pay something for it, although it was worth nothing. He thought Mr. Williams was quite ignorant of the matter at that time. He resisted Mr. Rawson's claim simply on his own reading of the specification, and on his knowledge of their own process. In 1893 or 1894, he had an interview with the Official Liquidator of Woodhouse and Rawson, with reference to his allegation that the Company were infringing Rawson's patent. When they met, the Liquidator said the estate had a very valuable patent which the Company were infringing. He told him he did not think it was worth anything. During the conversation, Mr. F. Rawson came in; and it was arranged that Mr. Rawson should come to the works, and see their process. There was further correspondence, but no threat of proceedings until 1895. He wrote to Mr. Rawson in 1894, saying that the method of toughening was known to Dr. Welsbach in April, 1886, a description of which was to be found in a paper accessible to anyone in the English patent office. He also referred to a patent by Mr. Paget of September, 1886. In 1892, he ascertained, on a visit to Vienna, that toughening of mantles was commenced there in the early part of 1886. It was always his opinion that the idea came to the Rawsons from Vienna. He did not know anything about the patents applied for in France, Germany, or the United States.

Wednesday, July 21.

Mr. *Moeller*, further cross-examined, said he had not found the letter of August 24 to which he had replied in September, saying Mr. Rawson must have known of what Dr. Welsbach had been doing. In 1890, he was in Vienna and learnt that the origin of the toughening process was to be found there in the Austrian patent of April 29, 1886. He referred to this patent in his letter. The first German patent of Dr. Welsbach was in September, 1885, which corresponded to the English patent of the following December in some respects. It made no allusion to toughening. The one he referred to was that of April, 29, 1886, which would be the date of the application. It described the incandescent body as being dipped in a dilute india-rubber solution, or the like, and then slowly dried. There was no claim made for this process. He did not know that Rawsons obtained a German patent for their process. Another application for a patent was handed to witness, dated April 28, 1887, which was almost identical with the German specification, but had collodion introduced into it; and another document, being the final specification of the patent of 1886, had collodion also. Dr. Welsbach had not been asked to give evidence. Witness had spoken to him on the matter; and he said he did not recollect much about it. He was a nervous, shy man, and would not give evidence. The first year his Company paid a dividend was in 1893. It then began to be really successful.

Re-examined: Dr. Welsbach took out patents in Austria as well as in Germany.

The Austrian patent was then put in by Mr. Moulton; and Mr. Bousfield drew attention to a statement upon it that "the description submitted on November 15, 1887, forms the exclusive basis for the patent granted."

Re-examination continued: He had nothing to do with the American patent, beyond acting as agent for the Company. In 1886, he had no personal communication with Dr. Welsbach.

Mr. *Ernest Nienstädt*, of Vienna, said he was a chemist, and had known Dr. Welsbach since 1885. He had acted for him in the sale of his patents; and he also worked with him in his laboratory. He remembered experiments with reference to the strengthening of mantles in the beginning of 1886. They tried everything possible, including shellac and collodion, to get over the difficulties which were reported from England as to the fragility of the mantles. He also worked separately from Dr. Welsbach, making similar experiments. Mr. Williams was in Vienna several times. He was there in February, 1886, and again in the summer. He remembered discussions on this matter between Dr. Welsbach and Mr. Williams. Mantles which had been strengthened by shellac, india-rubber, collodion, and other things, were shown to Mr. Williams. He believed two dipped in paraffin were shown; but they did not care much for paraffin. Some mantles were sent to England in the summer of 1886.

Cross-examined: He had no notes of his experiments; and he had no documents by which to fix the dates. He was not aware of any mantles being sent to England in 1887; but he knew some were forwarded in June or July, 1886. He translated many letters from Mr. Williams to Dr. Welsbach, but had not got them now. At present witness was living in New York, where he was communicated with by the defendants. They did not ask him if he had any letters or documents. He left Vienna in 1887. He fixed the dates entirely by memory. He remembered a paraffined mantle coming to Dr. Welsbach from England.

Re-examined: It was sent over in a box, bedded in a solid block of paraffin. Dr. Welsbach was working in the University laboratory when he made the experiments referred to. He remembered £10,000 being paid to Dr. Welsbach in February, 1886.

Mr. *Williams*, re-called, said he was one of the Directors of the defendant Company. He had had a great deal to do with Dr. Welsbach since October, 1885. He was in partnership with him, and organized the Welsbach Incandescent Company in England, in December, 1885, to introduce the invention. He was Managing-Director of the Company. In the course of 1886, he was frequently in Vienna, and practically lived with Dr. Welsbach. He was not a chemist; but he watched all operations which he could understand. He could not remember the exact date when the £10,000 was paid by the Welsbach Incandescent Company. The first experiments in toughening mantles that he saw were in the early part of 1886. Dr. Welsbach purchased a house in the Theresiana Gatze; and the ground floor and basement were converted into a laboratory. He thought he commenced working there in the autumn of 1886—in August or September. He formed a company for the manufacture of the impregnating fluid. The title was "F. Williams, Ltd."; and the Company was incorporated in July, 1886. He was in Vienna that month, returning on the 28th. The Company rented the basement of Dr. Welsbach's house; and he was then just moving in. Witness had a contract for the sale of the American patent, in which there was a clause that the mantles must be in a fit state for shipment; and he therefore impressed on Dr. Welsbach the necessity of devising some means of rendering them portable. He said they could be dipped in shellac and various other substances; but the shellac would break. They must find some other substance which would do better. He brought mantles from Vienna to England, in February, 1886, which stood the journey all right. They must have been strengthened with something—probably shellac. He fixed the date by a letter to Mr. Montgomery, his agent in America. Mr. Montgomery was in England, and went with him to Vienna in May, 1886. They spoke to Dr. Welsbach about the stiffening of mantles, and told him something better must be found. He thought he commenced employing the firm of Woodhouse and Rawson in April, 1886. In May, Mr. Rawson was at work on a burner. On September 11, 1886, he wrote to Mr. Montgomery, from which it appeared that some cones had been despatched to that gentleman in New York from Vienna in July or August. They could not have been sent that distance without toughening. They were toughened; but they were useless notwithstanding, as they broke. Mr. Arthur Paget, of Loughborough, was working for the Company at this time. He often discussed matters with Mr. Rawson; and he saw Mr. Donkin, their chemist, and a Mr. Edmonds. He showed them how to make the mantles; and as they went on making them, whenever he called at the works he told them what he had seen in Vienna. On one occasion Mr. Rawson suggested paraffin; and he said he would try it himself. He did so in Jeffreys Square, but found it of very little use. This was about July. He told Mr. Paget what had been suggested; and he said he would also try paraffin. Both Mr. Rawson and Mr. Paget took out patents for the same thing within a day or two of each other. In his opinion, paraffin was practically no better than shellac; they had much the same faults. When the paraffin got hard, it broke. The defendant Company had a great deal of trouble to find out a solution which was practically useful. He did not think they succeeded until about 1888. Experiments were made all over the world.

Cross examined: He believed that the mantles of which he wrote to Mr. Montgomery were toughened with shellac. He was not aware that Dr. Welsbach was then trying to strengthen them in an entirely different way. There were some applications in 1886; and in the Austrian patent there was a reference to dipping. Patents were taken out everywhere; but there was no mention of toughening in any of them, because Dr. Welsbach always said there was no patent in it. The only difficulty was to find the right substance. He did not know anything about the patents. The English patent of December, 1886, was put to the witness, in which reference was made to strengthening the mantles by mechanical means—such as extra threads or platinum wires—but he said that had nothing to do with fitting the mantles for transport. Dr. Welsbach always said that the incinerated mantle was an ash, and that one could not strengthen an ash; he was therefore not experimenting with that view. In the early part of 1887, he gave an exhibition in Pall Mall, and had to get girls over from Germany to make the mantles on the spot and put them on, so as to show them to the best advantage. In August, 1887, an English patent was applied for, with the object of making mantles capable of transit, by dipping them in a weak solution of caoutchouc or collodion; but he never saw it tried, and could not say anything about it. The first solution he saw which was practically useful was in 1888; and he believed it came from America. The method of introducing extra threads and wires did not prove successful; none of them would bear transit at all—or none that he had ever seen. He had no doubt the mantles of which he wrote to Montgomery had been dipped in shellac. He packed them himself very carefully, and

brought them with him. He knew nothing about the German specification. He believed collodion was mentioned in the application for the Austrian patent in April, 1886, because the Austrian Patent Agent told him nothing could be added to an application after it was sent in. Mr. Rawson did not show him what he had done with paraffin; he told him. He could not say which Mr. Rawson it was; nor which one it was to whom he communicated what he had seen and heard in Vienna. He might have got three specimens from Messrs. Rawson; and sent one to New York, one to Vienna, and one to Berlin, but he did not remember. It was some time in July they told him of the paraffin experiment. Mr. Rawson said nothing about taking out a patent. He mentioned it to Mr. Paget, but did not suggest that he should apply for a patent. With regard to the specimens of paraffined mantles said to have been sent abroad, he could not remember having any information as to how they stood the transit; but his impression was they all broke. He was not aware that Rawsons made some thousand paraffined mantles towards the end of 1896, or that 600 were sent out to various customers; some by post. At that time the Company were doing no business practically; it was simply a Syndicate to exploit the thing. In 1886, Messrs. Rawson could not make mantles properly, let alone dip them in paraffin. When he complained of the mantles, they complained of the fluid. He still maintained that paraffin was of no practical use. He did not know that they used a mixture of paraffin and benzole. They only mentioned paraffin wax; and he tried this and found it useless. In his experience shellac was no use. With defendants' present mantles, the breakages in transit were 3 per cent. He tried paraffin himself; melting it, dipping the mantles in it, and then letting them dry. He did not find it answer. He was not at all jealous of Messrs. Rawson. He paraffined perhaps a hundred mantles, and broke a great many in doing it. He did not think it was any better than shellac, as it ran down the burner and clogged it. There were a number of chemists working at this subject for a long time; but Dr. Welsbach himself did not do so. There had been an action in France; but he knew nothing of the details, He was not aware that one of the questions raised was whether it was possible, in December, 1886, or January, 1887, to transmit mantles from Vienna to Paris; or whether those exhibited at the Grand Café at the time were made in France. He made an affidavit in the action, in which he stated that there was then no known process of varnishing which would render the incandescent body firm, and consequently it could not be imported in its impregnated and burnt-off state. As soon as he saw the Rawson patent, he said they must have taken the idea from him.

Re-examined: He superintended the installation at the Grand Café in Paris, in conjunction with Dr. Welsbach. The materials were taken to Paris, and the mantles were made there, in order to comply with the French patent law. He had never heard before that Messrs. Rawson were employed to sell the mantles. There was no secrecy about the use of paraffin by Messrs. Rawson; and he had no idea that it was wrong to mention it to Mr. Paget. It would have been very valuable if they could have got a practical method at the time for toughening the mantles.

Mr. MOULTON said he had one other witness; but he could not be present until the next morning.

Mr. BOUSFIELD said he might perhaps utilize time by calling rebutting evidence.

Mr. *F. L. Rawson* said his firm sold numbers of mantles in 1886. Their great difficulty was in the transport. They organized an elaborate system of agencies for supplying them throughout the kingdom, in accordance with the terms of their contract. The Company supplied them with webbing and with fluid; and they also tried to get webbing elsewhere. Before the hardening process was devised, the mantles were sent out ready mounted on the burners, and with a glass globe, carefully packed in a box. There were many complaints about the failure of the mantles in use; but the transport was always difficult, and he often discussed it with Mr Williams. He was quite certain he never suggested dipping at any time before the patent was applied for—neither in paraffin, nor in shellac. If he had, it would not have been honest to make the broad claim they did. His brother first mentioned the paraffin; and they consulted as to the best method of using it. He remembered communicating the discovery to Mr. Williams, who was very much delighted, and thought they had done a great thing. He could not recollect where it was that he first mentioned it to him, or when he actually saw the mantles which had been treated. The application of paraffin was a practical success; and it was commercially applied. His brother threw one across to him, and he either caught it or it fell on the ground without breaking. Directly the patent was applied for mantles were sent out. Hundreds were made. There were four or five girls constantly at work from September to about the beginning of December, when the Welsbach Company objected to their sending them out. Mr. Williams said the paraffining injured the life of the mantles, and therefore those sent to the Company might not have been treated in that way; but all mantles forwarded direct to customers were. He knew of no reason why the paraffin should injure the mantles; nor did he believe it did. He attributed the defect to the impregnating solution. The paraffined mantles were sent in the usual way, by post or parcel. They had no complaints of breakages in transit. He knew Major Jones, one of the Directors, who joined at his request, as did several of the others. He mentioned the patent to the Committee of Shareholders and also to the Directors; and the reply was that the Company not being out of their difficulties, it was premature to raise the question. The first he ever heard of Mr. Williams's suggestion that he and his brother borrowed the idea of dipping mantles from him, was quite recently—a month or two ago.

Cross-examined: Mr. Moeller told him that the same thing had been patented before. He was certain they made and sold mantles in 1886. The books were not now in existence. He could not recollect whom the mantles were sold to, or the names of agents. These details would be in the hands of the Manager. They issued price lists. The fluid was supplied to them by the Company, who got it from Vienna. Mr. Williams visited the works several times; but he should not say he was in the habit of visiting them frequently. His brother was responsible for the technical portion of the incandescent business; the manufacturing part was under his supervision. They first began working at the mantles; and the second thing was the burners. The question of paraffin came up about a month before the patent was applied for. Mr. Williams was quite aware of the importance of rendering the mantles transportable. He never suggested toughening them, or said anything about shellac, until after their discovery of paraffin had been made. If he had, it would at once have occurred to him that something else would do if shellac would not; and he should have sent instructions to the works for the chemists to experiment in that direction.

By Justice WILLS: The only suggestions offered for safety in transport were of a mechanical nature. He thought they had some correspondence with Mr. Pintsch on the subject of mantles; but he did not recollect the details. The Company had a right to use the patent on paying a 10 per cent. royalty. He and his brother repurchased this patent and the American one from the Liquidator of Woodhouse and Rawson for £500. It was sold to the plaintiff Company on April 11, 1895.

Thursday, July 22.

Mr. *F. L. Rawson*, further cross-examined this morning by Mr. MOULTON, said he had no doubt they were instructed, according to the entry in the Company's minute-book, not to proceed further with the manufacture of burners and galleries until more satisfactory results had been obtained. Other entries were read as to the supply of burners and mantles. On Oct. 6 it was resolved that no more lamps should be issued to the public; and on Nov. 29 it was reported that up to the 26th Messrs. Rawson had only sent out 75 burners. He still maintained that his firm supplied mantles to the public; and many more mantles than burners were sent out.

Re-examined: The paraffin experiments were conducted in the experimental department. There was an agreement with all the staff that experiments should be kept secret; and they never had a case of disclosure. No one could enter certain rooms without a pass; but among the staff there was no secrecy observed. The object was to get the best assistance of the staff for anything that was being worked at. He did not agree with the account given by Mr. Moeller of the interview with him at the Palmer Street Works, when witness was reported to have said that he was satisfied, and that the Company would hear nothing more about it. Mr. Moeller must have misunderstood him entirely. He had not been able to find a copy of the price lists of which he spoke on the previous day. He was certain that the mantles sent out after the patent was lodged were paraffined; and they had no complaints of their failure in transit.

Further cross-examined: The patent was sold to the plaintiff Company on the terms that Messrs. Rawson were to have £10,000 if the action succeeded, and a share of the royalties.

M. *Lucien Golfier* was next called. He said that from 1884 to 1889 he was Engineer to the French Company who manufactured the Clamond burners. The magnesian baskets were dipped in collodion to strengthen them. He brought some to England in 1885; and they were put on burners and lit. They were dipped in collodion by himself.

M. *Pottier* (who was examined in French) said he was a civil engineer in Paris. His uncle, M. Servier, was interested in the Clamond Company in 1882. He himself was asked to take charge of the Clamond light at the exhibition at the Crystal Palace. There were at least 20 lamps shown. The baskets were coated with dextrine to strengthen them. When they were lit, the dextrine was dissipated in smoke in a few seconds; and the basket then became incandescent.

Mr. MOULTON said this concluded the defendants' evidence.

Mr. *Rawson* was then recalled by Mr. BOUSFIELD to give rebutting evidence. He stated positively that Mr. Williams never said anything to him about dipping mantles in shellac or any other liquid. He thought of it one night when in bed; and the next morning he tried paraffin, which was a substance frequently used in electric work for the purpose of insulation. He explained that when he said no secret was made of the process in the works, he only meant among the staff. Except in very special cases, this was the usual practice in all matters for which patents were taken out. He corroborated what his brother had said as to the use of paraffin after the patent was lodged, and the thoroughly successful results it yielded. He did not remember any difficulty arising from the brittleness of the paraffin. He made special experiments to see if the burning off of the paraffin affected the life of the mantles; and he satisfied himself that it did not.

Cross-examined: There were various kinds of paraffin; some being cheaper than others. Ozokerit was cheap. The Sunlight Company did not use paraffin.

Mr. BOUSFIELD said they had obtained some of Mawson's collodion, and when diluted with ether it worked very well; and the same with flexible collodion. He could give evidence of this, if necessary.

Mr. MOULTON said he would admit that.

Mr. *Mintz*, a patent agent of Berlin, said he had carried out investigations at the Berlin Patent Office, and had made true copies of the applications by Dr. Welsbach in April, 1886, and April, 1887. They were the documents which had been put in.

Cross-examined: There were no intermediate specifications between the two he had mentioned. The second document was filed in consequence of questions raised by the Patent Office. It was against the rule to add new matter to an application.

This concluded the rebutting evidence.

Mr. BOUSFIELD obtained his Lordship's permission to defer his reply until next day.

Mr. MOULTON said it would be very convenient to him if he also might defer his summing up of the defendants' case.

Justice WILLS said he would oblige Counsel if he could find something else to go on with. It seemed to be mainly a question of the construction of the specification. If the broad interpretation of the claim were accepted, there would be a good deal to be said on the question of anticipation. On the other hand, if it were confined within the narrower limits, it would be a question whether there had been any infringement. There was really no dispute about the facts.

Mr. MOULTON said it was a case in which his learned friend had to choose which horn of the dilemma he would impale himself upon. If he claimed everything, he was anticipated; if he claimed only things of the type specified, the defendants did not infringe.

Justice WILLS said these were the lines on which he should look for assistance from Counsel on either side. All the rest of the case seemed quite clear. He might say that he did not think an anticipation had been made out in the sense of its having been communicated to Messrs. Rawson. The evidence on this point was too doubtful. It was only right to say that both the Messrs. Rawson had made a favourable impression on his mind; and he accepted their evidence. On the other

hand, Mr. Williams had also made a favourable impression upon him; but there was room for mistake in what he had stated.

Mr. MOULTON said this was not, to his mind, the substantial issue. The anticipations he relied upon were those of Bright, which, according to Mr. Imray's evidence, was in habitual use, and Clamond, as to which there was no dispute. The question of infringement would, of course, depend on the construction of the patent, upon which he would have to refer to some authorities.

Justice WILLS here said he found he could meet the convenience of Counsel by deferring the arguments until next day.

Friday, July 23.

On the proceedings being resumed this morning,

Mr. MOULTON, in summing up the case on behalf of the defendants, first dealt with the anticipations, and submitted that Bright's specification was a clear anticipation of this patent. After this it was impossible, he said, to assert that there was any novelty in the idea of dipping into a fusible substance for stiffening, or choosing that this fusible substance should be combustible where the article was afterwards to be put into a flame so that the combustible body would pass away. He then dealt at considerable length with the Clamond anticipation, and read passages from the evidence in support of his contentions—finally putting the substance of his argument in the form of the following syllogism: No one could prevent Clamond from continuing to do what he had done; if a patent could be granted for strengthening mantles by dipping them, Clamond could have been restrained; therefore a patent could not be granted. He then referred to various cases, particularly *Betts v. Neilson*. He contended, therefore, that it was impossible to support the first claim as being novel; and he then pointed out that, with regard to infringement, no interpretation of the patent could help his friend but the broad one of the first claim. There was an interpretation of the patent which would make it much more limited—viz., that the patentees were only thinking of using substances solid at ordinary temperatures. What the defendants used was not solid at ordinary temperatures—in fact, elevation of temperature was that which most quickly rendered the coating solid. Their coating was obtained not by the liquid becoming solid, but by the liquid passing away and leaving the solid residue. But this was clearly not indicated by the patentee. The thing to be found out at the date in question, was not the idea of stiffening, which was old, but something which would effectively and successfully stiffen; and he submitted that, on the evidence, this was never found out by the patentees. Mr. Williams tried paraffin, and found, as a practical man, that it would not act to the degree of excellence which would make it worth while applying it. The disadvantages were greater than the advantages. He concluded by saying that the idea in its breadth was certainly not novel; that the practice of dipping things into liquids to stiffen them and make them bear transport was known; that, if this was known, no such claim as the first one would be valid; and that if the first claim was to be limited to liquids of the type of paraffin wax or any others which varied by temperature, then the defendants did not infringe.

Mr. BOUSFIELD, in reply, said what his Lordship had already said with regard to the communication of the idea by Mr. Williams relieved him from going into that part of the case. It was not pretended that Dr. Auer von Welsbach invented this, or first conceived the idea; but somehow among his chemists in Vienna experiments were made—he being engaged on more important things. He submitted that there was no evidence sufficiently precise in detail to warrant the inference that any really stiffened mantles were introduced into England from Vienna before the date of the patent. The case was then reduced to very small limits. The evidence of Messrs. Rawson was perfectly clear as to the practicability and commercial utility of the invention; and not a word had been put to the scientific witnesses of the defendants as to the alleged brittleness of mantles treated with paraffin. Mr. Williams said he had tried it, and did not succeed; but he gave no details as to the kind of paraffin or the method of work. On the question of construction, there was no doubt the intention was to make a broad claim sufficiently wide to cover dipping in collodion instead of paraffin. He then submitted that the anticipations relied upon, of Bright and Clamond, were so different as to have no effect upon the plaintiffs' patent. No case could be produced where it could be said that the introduction into this country of an article made abroad by a certain process, anticipated a subsequent patent in this country for that process, unless the article by its nature revealed the method by which it was made. Taking it as admitted that the Clamond baskets were introduced into this country, that they were seen to have a brown glaze upon them, and that when they were first lit the flame was smoky, this revealed nothing as to the way in which they were made; and therefore they could not be said to anticipate the plaintiff's process of dipping. Nobody could tell that the brown glaze was for the purpose of strengthening the baskets; and it might readily be supposed it was for protecting them from damp.

Justice WILLS said it was suggested that one could not prevent a man doing that which he had been in the habit of doing.

Mr. BOUSFIELD doubted whether this was a correct statement of the law. The Courts had held that a man was entitled to a patent who, going abroad and discovering a secret process, returned home and established a new industry by the practice of the process. It was held to be a meritorious thing to enlarge the trade of the country by going abroad, which in olden times meant the expenditure of a great deal of time and money, and finding out how things were done, and establishing a new home manufacture. Moreover, the plaintiffs' patent could not interfere with the users of Clamond's process, because the patent was confined expressly to improvements in the manufacture of the Welsbach mantle, and the Clamond basket was nothing like that fragile mantle. The defendants had urged that, without experiment, no one could tell, outside paraffin, what substances would succeed; but this was only an argument for holding the patent bad on account of insufficiency of description.

Mr. BOUSFIELD: That is my argument. In the case of the telephone transmitter, Edison had not the slightest idea that his invention could be carried out in so many different ways; but though they required experiment and invention by the persons who used them, they were all stopped as infringements of his general idea.

Justice WILLS said a very important point was whether the patentee claimed all methods of effecting the object, or whether his claim was limited to wax-like substances. He was not at all clear on this part of the case.

Mr. BOUSFIELD said it was perfectly clear that the Rawsons thought they had invented broadly the method of stiffening by dipping, after ignition, in substances which would set hard; and the words of the specification were sufficiently wide to include setting by cooling and by evaporation. The defendants' contention that the reference in the patent to the use of a volatile hydrocarbon to mix with the paraffin was for the purpose of making the latter fluid, could not be right, because of the alternative suggestion in the patent that a high boiling-point paraffin such as ozokerit might be used. It would be a great straining of language to suppose that the hydrocarbon was referred to for the purpose of getting the paraffin fluid. Heat was contemplated for obtaining fluidity; and the volatile hydrocarbon was used so that it might evaporate, and leave a residue of wax on the mantle. The specification clearly involved not merely the setting which occurred on reduction of temperature, but also that which took place by reason of evaporation of the solvent. There was nothing to limit the generality of the language of the specification. The particular kind of setting which took place had nothing to do with the success of the invention, which consisted in dipping the mantle, after ignition, in a liquid which would penetrate the interstices, and afterwards set to such a degree of hardness as to protect the mantle from injury. In conclusion, the learned Counsel submitted that Messrs. Rawson had made a very important step at a very critical time, and were entitled to the reward which would follow the practical solution of a problem.

Justice WILLS, in giving judgment, said the most important question in this case, as in many others, was as to the construction of the patent. There was no room for doubt as to the subject of it, which was clearly stated to be "Improvements in the manufacture of mantles connected with the production of light by the Welsbach process." It then went on to explain that difficulties had been found in the transport of these mantles without breaking, and various methods had been proposed; and then it said that the difficulty might be overcome by dipping the mantle, after ignition—*i.e.*, in the state in which it had to be used when in a very fragile condition—into a liquid which would thoroughly penetrate the material and set to such a degree of hardness as to protect it from breakage, and which could afterwards be removed without mechanical injury to the lamp, and without leaving any objectionable residue. It then proceeded to describe a satisfactory method of doing this, which was what might be termed a paraffin or wax method. It next went on to say that other materials might be employed, so long as they set hard at ordinary temperatures, and burned away without injury or leaving an objectionable residue. But the patentees found that paraffin was the least sticky, and was better than any others. Then came the claims, which were, first, the treatment of a mantle after ignition, by immersing it in a liquid which would afterwards set, and would burn away without prejudicial results to the mantles, for the purpose set forth; and, secondly, the use of paraffin substantially as described in the treatment referred to in the first claim. It was obvious to his mind that the patentee considered he had got hold of a new idea, so far novel that it would give him the benefit of principle which had been applied to certain classes of patents embodying new ideas—viz., that, having shown one successful method of accomplishing his object, he was entitled to protection against all methods by which the same object could be accomplished. It was quite clear that this was the view on which the patent was framed. Then came the extremely important question—to his mind *the* question in the case—viz., how far the generality of the claim extended. It was clear that, in terms, it was a claim to the treatment of mantles after ignition by immersion in a liquid which would afterwards set. There were two kinds of setting essentially distinguishable in their chemical and physical properties and nature. It was also clear that the expression "set" had been commonly used with respect to both of them. If, therefore, there was nothing in the patent to limit the expression to one class of setting, it would undoubtedly be general; and the real question on which he had heard a very able argument on each side, but which, when he came to consider it, he thought was tolerably clear, was: Was there in the patent an indication that meant to limit it to substances generally of the wax or paraffin type? The essential difference between the two appeared to be this—that, with regard to substances of this type, a setting was effected by a reduction in temperature. They were substances which dissolved in the liquid at a considerable temperature, and afterwards set by cooling, which he understood was a molecular change due to lower temperature. It was a process in which he thought evaporation played so subsidiary a part that it might be neglected. On the other hand, in the case of collodion and similar substances, the setting was effected by evaporation; and the lower temperature played no part, or if it played any part at all it was to retard and not assist the operation. Therefore, there were these essential differences between the two classes of setting. In investigating this question as to whether in the specification there was to be found a limitation of the setting by the former process, he was not unmindful of the fact that, under a patent of this kind, which was framed upon a new idea or principle which was being carried out in one way, it was not a sufficient answer to say that the only way pointed out indicated only one particular kind of setting, though, of course, it was a circumstance to be taken into consideration in endeavouring to ascertain what was in the mind of the patentee, and what he was conveying to the public. But it seemed to him that the key to the interpretation of the specification on this point was to be found in the words "other materials may be employed, so long as they set hard at ordinary temperatures." He could not doubt that what the patentee meant was that they were to be dealt with at a higher temperature, and were then to set on arriving at the ordinary temperature. He could not see why a reference to ordinary temperatures should be introduced, except to stamp this idea into the patent. It followed that, in his opinion, the patentee did not intend to claim, and had not claimed, any setting, except that which was effected by the operation of cooling. This seemed to be the key to the whole thing. Suppose it had turned out that collodion was an impracticable substance, and the patent had been attacked on that ground, and it had been said: "You have embraced something utterly impracticable, and therefore, the patent is bad," the patentee would have answered, "I have shown you in my illustration nothing but a kind of setting in

which cooling is required, and I have told you in the enlarging part of my description that I refer to other substances which will, like wax, set at ordinary temperatures. So understood, there was a wide field of substances over which the patentee had a right to range, and to claim the benefit of the operation of the principle—viz., that, having embodied a new idea in his patent, and having shown a practical method of attaining the object in question, he was entitled to extend it to other things besides those specifically mentioned. It was a patent which would include shellac, dextrine, and a number of other substances on the same footing, and would give him a wide field. It was not necessary to say more on this question. Those seemed to him to be the guiding lines; and he would only add that he doubted very much if a claim so wide as to include every kind of setting by any liquid, no matter what it was, or how it operated, could be sustained—whether it would not be pushing the principle a great deal too far. It seemed to him even that the principle ought to be confined to substances or operations which presented some analogy to the process which was described and specifically claimed; and that the essential differences which he had pointed out between the two processes prevented the one from having such a necessary analogy to the other as would prevent it being applied in case the widest application of the patent were adopted. But, for the reasons he had mentioned, he thought the proper construction of the patent was the narrower one he had indicated. The patent had been attacked on the ground of anticipation; but he was against the defendants upon all the anticipations. He agreed with Mr. Bousfield that the notion of dipping one of the Welsbach skeletons, with its extraordinary fragility of structure and its earthy constitution, into this substance for this purpose could hardly be said to have been anticipated by the dipping of a cotton fabric—the wick of a moderator lamp—into a solution of wax. The things were too far apart; and he should be very sorry if he felt it his duty to upset a meritorious patent on such an anticipation as that. He thought it was too far off what had been done in the present instance; and the application of something like it to the circumstances of this case, involving invention, independent thought, and consideration, might very well stand in spite of the anticipation of the idea in the rough, not merely by this patent of Bright, but by a thousand things in daily operation—not excluding the starching of shirts, to which Mr. Bousfield had referred. Of course, in that case the starch was not burnt off the shirt afterwards. But the general notion of strengthening in that kind of fashion was an old one; and if it were to be applied to a substance to be used in the way these mantles were, the burning-off would follow as a matter of course. But he did not think that anticipation would damage the process. With respect to the Clamond process, again, he thought it came uncommonly near to it; and if there were sufficient evidence of it being known in England to make it part of the general knowledge of the subject, he should say it was essentially the same thing—that was adopting the larger construction and supposing it included collodion, though as it also included dextrine it really was an anticipation, because the baskets of Clamond performed exactly the same function as the Welsbach mantles, and they were treated substantially in the same way for the same purpose. But he thought Mr. Bousfield's argument on this point was well founded—that the mere fact that it was used in England without anybody having the opportunity of seeing what was being used ought not to be enough, and, in his judgment, was not enough, to make it a prior publication. He asked M. Clamond himself whether the burning off of these things was made part of the public exhibition; and it seemed that it was not so, and he only let people see what he wanted them to see—viz, the incandescence of the magnesia basket. This, therefore, was not such an anticipation as to have made what he did part of the public knowledge on the subject at that day. Mr. Moulton's test—by which he sought to make it out that if a person who had been in the habit of doing certain things in England, by a patent taken out subsequently might embody what he had long done, and that if he did the patent would not be good—might or might not be a good test. He would not express an opinion off-hand; but it seemed to him not worth considering, because Clamond did not propose to apply this process to Welsbach mantles, but to his own particular fabrics, and therefore there would be nothing in this patent which would interfere with Clamond after the patent doing exactly what had been done before. There remained the question of anticipation by communication to and by Mr. Williams. It was sufficient to say on this that he thought that was left far too doubtful. He spoke with respect of the evidence given by Mr. Williams, which was very creditable to him; but he also wished to speak in the same way of the evidence of Messrs. Rawson. They seemed to be speaking the truth emphatically; and he could only suppose that some misconception may have arisen. It was not worth inquiring into; but he believed Messrs. Rawson's statements that nothing of this kind had ever been conveyed to their minds, and that one of them was the true originator of what he had invented. He was very sorry to have to decide against anybody; but he could not honestly give to his patent the wide construction which would be necessary for him, and those now representing him, to claim for it in order to succeed in this action. A good deal had been said on the question of utility; but that he should deal with very briefly. He did not think that commercial success was at all the test of the utility of a patent. Very many meritorious patents would go to the wall if it were so. Probably the Welsbach patent at one time might have been attacked on that score. It was attacked before him on that very ground last year; and he made very short work of it. He should like to make equally short work of it in this case, by saying that beyond question there was a degree of utility in the patent. It did not in the least follow that, because better things were done afterwards, it was not a substantial contribution to the knowledge of the world. The only remaining question was that of infringement; and what he had said with regard to the construction of the patent disposed of it. If it were limited to wax-like substances, collodion was not an infringement. He did not know that the eradicable difference between two processes could be better illustrated than by pointing to the use of the hot-air bath in both systems. In the plaintiffs' process, the hot-air bath was used to keep the paraffin in solution, not to drive off the volatile hydrocarbons. If it did drive off some of it, the purpose for which the heat was supplied would be defeated, and the paraffin would run down to the bottom; whereas in the defendant's process the use of the hot-air bath was to drive off the volatile stuff, and so hasten the operation. This use was diametrically opposed to that of the patentee. The result was that he found for the defendants on the question of infringement; but on all the other issues, except the one about the expiration of the patent, which was of no consequence whatever for the present purpose, he found for the plaintiffs. Of course, he must give judgment for the defendants on the ground of non-infringement; but the plaintiffs would have the costs of all the issues except that.

Mr. TERRELL suggested that the defendants ought to have the costs in the action.

Some discussion ensued upon this point; but in the end his Lordship adhered to the decision above stated. The defendants would have the general costs of the action.

On the application of Mr. BOUSFIELD, his Lordship certified that the validity of the patent came in question.

A Bankrupt's Gas Bill.

In the Recorder's Court, Dublin, on the 16th inst., the Alliance and Dublin Gas Company sued Mr. J. J. Lalor, a stationer, and formerly publisher of the "Nation" and the "Irish Catholic," for £5 12s. 9d., for gas supplied to his premises. The defence was that Lalor, on Sept. 8 last year, became an arranging trader (his liabilities being about £6000); and he subsequently managed to effect an arrangement to pay 4s. in the pound. In November, he executed a deed by which he assigned the trade debts, the plant and machinery, the copyright of the newspapers, and some policies of insurance on his life, to Mr. W. M. Murphy, in consideration of the payment of the 4s. in the pound. Murphy carried on the establishment; and on the gas bill being sent in he refused to pay it—saying it was Lalor's debt. The Recorder held that the contract was between the Company and Lalor, and that the latter had no defence. He accordingly gave judgment for the amount claimed.

The Law Relating to Water Supp'y in the United States.

Two recent decisions of United States Courts, which have reached us through the "Engineering Record," are of sufficient importance to be briefly noticed.

First of all, as to the law requiring municipalities to purchase existing water-works before undertaking the supply on their own account. According to a decision of the Supreme Court of Montana, this law is unconstitutional. The question of the validity of the law came up in an action brought by the Helena Consolidated Water Company to enjoin the City of Helena from advertising for bids or letting a contract for the construction of a system of water supply. The contract entered into by the city with the Company ended on Jan. 1, 1897; and the city refused to renew it on the ground that the charges were exorbitant. The Company declined to lower the rates; but the city continued to use the water. For this, the Company brought an action to recover; and it is still pending. Then, by a special election held early in 1895, the people authorized the Council to extend the debt of the city so as to procure a water supply. The Council advertised for tenders; and the Company sought to restrain them under the section of the political code which provides that municipalities must buy existing plants before establishing systems of their own. An injunction was granted, and the city appealed to the Supreme Court. It was understood that the Company wanted $1,300,000 for their plant, which was considered by the City altogether too high.

A case on somewhat similar lines occurred at Warsaw (N.Y.). The Water Commissioners began to construct works; whereupon the local Water Company brought an action to prevent them from doing so without first acquiring the existing rights. The Fourth Appellate Division of New York State has affirmed judgment in favour of the defendants; holding that the Company could not compel the Commissioners, acting under the authority of the General Act of 1875, to acquire their privileges and franchises against their will, notwithstanding that the Act incorporating the Company invested the Trustees of the village with the power of regulating the manner in which the pipes and structures of the Company should be laid and erected, authorized them under certain conditions to subscribe to the capital stock, and enacted that the Company should furnish water to the Trustees for extinguishing fires and other purposes as might be agreed upon between the parties. The Court held that the provisions of the Act of 1875 permitting Boards of Water Commissioners to institute proceedings to acquire the "rights, privileges, grants, and property" of water-works companies did not require the Water Commissioners of a village to do this where they deemed such action unnecessary or inexpedient.

Carpenter v. Commercial Gas Company.—Our attention has been called to an error in the report of Dr. Haldane's evidence in this case, given in the "JOURNAL" for the 6th inst. The sentences on the 11th and three succeeding lines of his examination-in-chief (p. 53) should have read as follows: "To some persons, 1 part of sulphur dioxide in 500,000 parts would be deleterious. Four grains per cubic foot would be about 1 part in 350 parts by volume. Breathing this mixture," &c.

The Richmond Gas-Meter Case.—We learn that the Directors of the Richmond Gas Company have served notice of appeal upon the Richmond Magistrates who recently decided that the register of a gas-meter is only *primâ facie* evidence of the quantity of gas consumed (see *ante*, p. 122). The Magistrates based their decision on section 20 of the Gas-Works Clauses Act, 1871, according to which it is to be "final and binding on all parties." The Justices consider that these words will prevent the Company succeeding on an appeal, and that the proper course would have been to have had a case stated for the High Court.

MISCELLANEOUS NEWS.

EUROPEAN GAS COMPANY, LIMITED.

The Annual Meeting of this Company was held yesterday week, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. J. Blacket Gill in the chair.

The Secretary and General Manager (Mr. W. Williams) read the notice convening the meeting, and also the following report of the Directors:—

The Directors have the satisfaction of reporting that the consumption of gas at the Company's stations shows, in the aggregate, an increase of over 2 per cent. This increase has been greatest at Havre; but four other stations—viz., Nantes, Bolbec, Amiens, and Rouen—exhibit a satisfactory advance. Caen and Boulogne show a decrease in rental; but recent returns from both these stations are much more favourable, and justify the Directors in expecting better results there this year.

The increase in the sale of gas at Havre and elsewhere is entirely owing to extension of business among small consumers, who are given every possible facility for taking gas, under various systems of fittings on hire, among which the prepayment meters, alluded to in previous reports, have met with especial favour. In all these cases, however, the initial outlay for such fittings has to be provided by the Company; and consequently a considerable expenditure has been incurred during the past year for this purpose.

Coals have cost less than during the preceding year; but the revenue from both coke and sulphate is again less. Tar is the only residual which has yielded an improved return.

The Directors have sold some land at Boulogne which was not required for the Company's operations, and will endeavour, as opportunities occur, to further reduce the capital at that station.

The Town of Bolbec has given the Company notice that gas is to be entirely superseded by electricity for public lighting; but as the Directors are advised that this would be a breach of the treaty between the Town and the Company, they have decided to institute proceedings for the purpose of having the contract interpreted by the proper tribunals.

The profits for the year enable the Directors to recommend the payment of the usual dividend—viz., 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, less the interim dividend of 8s. and 6s. per share respectively paid on the 1st of February last; also the payment of a special bonus of 1 per cent. on all shares according to the amount paid thereon—leaving £1654 to be carried to the reserve of undivided profits.

Notice has been given that two Directors (J. Blacket Gill, Esq., and E. T. E. Besley, Esq., Q.C.) and both Auditors (J. Reeson, Esq., and F. M. Fry, Esq.) retire from office at this meeting; but, all being eligible, they offer themselves for re election.

The Chairman said he thought the shareholders, having heard the report read, would agree with him that there was not much more for him to say; and briefly he offered them congratulations upon what he considered was, taking it all round, a very satisfactory statement. It would be noticed that they had had an increase in the consumption of gas of about 2 per cent., which compared favourably with the previous year; but anyone who visited their stations, and walked about the streets of (say) Havre and Rouen would, he fancied, be surprised to find they had had this increase, because most of the shops and large cafés one saw were lighted by electricity. At Boulogne, their Manager had made vigorous efforts to re-capture one or two of the cafés, with the result that one was again lighted by gas, and another was half lighted by gas and half by electricity. The Company had a great deal to contend against; so that he thought they had done well in not only maintaining their position, but in improving it. They had to thank the incandescent burner for assisting them very materially in this fight against their powerful enemy. It would be observed that the report alluded to a little disagreement they had pending with the Municipality of Bolbec, who thought they had a right to give notice that they would terminate, in November next, their arrangement with the Company to supply the public lamps with gas. The Board and also their legal advisers believed that while the Municipality possibly had power to light the town with electricity, they were bound also to take and pay for the minimum quantity of gas specified in the treaty. This question was now being submitted to the proper tribunal, who would interpret the terms of the treaty. Bolbec was only one of the smallest of the stations, and was situated a short distance from Havre. The town consisted principally of cotton-mills; and therefore, even if the Company did lose the public lighting, it would not be a serious matter. But there was a principle involved; and the Board contended that the Company had the right to continue the supply of gas—at any rate during the next thirty years, which was the term of their concession. Two or three weeks since, Bolbec was visited by a fearful storm; and the gas-works, being situated under the brow of a hill, were in some danger. But their Manager, assisted by the men, worked so admirably that very little damage was done; and the Board were glad to recognize the services of all who worked so well for the Company on that occasion. They had this year experienced an unfortunate loss by the death of M. Coindet, who was their Engineer and Manager at Havre. For forty years he had worked, in a most exemplary manner, for the Company; and one and all felt deep regret that he had been called away. There was a trait in M. Coindet's character, of which he (the Chairman) would like to give an illustration. The Board knew he was suffering from a very serious illness; and they unanimously suggested that he should retire upon full pay. But he said he would not; he would stick to his post as long as he was able, and then, if he felt he must go, he would only take half his pay. One ought to bear willing testimony to a man of that kind; and it was through men like him that the shareholders reaped such great advantages as they did. The Board had appointed M. Gaston Gautier to succeed M. Coindet at Havre; and the Sub-Engineer at Nantes had been made Chief Engineer of that station. Another old servant had departed this life. That was Mr. Goldsmith. whom some of the older shareholders would recollect as having been for many years Chief Clerk. He served the Company for 48 years. Adverting to the accounts, the Chairman said the gas-rental had increased by £4976, to which Havre, Nantes, Bolbec, Amiens, and Rouen had contributed; but there was a falling off at Caen and Boulogne. At Caen, the electric light had made its appearance; and they were suffering much from it at the present time. Boulogne was a station they had had great hopes of; and the French had hoped that some day it would equal Cherbourg. Large sums of money had been spent on the harbour there; and the Company had expended a considerable amount on works for supplying gas to the town—perhaps more than they should have done. The Directors were therefore glad in having been able to sell some of the Company's land there for £1200; and so reducing somewhat the capital of that station. One of the most interesting features of their working was the extension of the stove and engine business. They had now 46,000 stoves fixed; and 332 gas-engines, which were equal to 1047-horse power. Electricity could not very well touch this branch of their business; so that they would always derive something therefrom. The number of consumers had increased by 5720, which was accounted for by the fact that very many coin meters had been fitted up at Rouen and Havre. The item of coal showed a saving on the preceding year. The contracts would continue for another year, and at the same rate as in the last twelvemonth. Coke unfortunately exhibited a loss of £500; but this was not peculiar to France, because in this country the coke market was not particularly bright. The proceeds from coke were £4750. The receipts for tar were £400 more. Sulphate, which (as in this country) had been at a low price, showed a diminution of £814; but still he thought they had come out pretty well in regard to this product, seeing that they had made £3210 from it. Bad debts had increased by £140; but as the total of that item was only £514 on a rental of £240,000, he did not think they had much cause to complain. The increase no doubt arose from the fact that at Havre they had reduced the deposit by consumers on account of a similar measure having been adopted by the Electric Light Company. The mileage of mains had been increased by four, which made the total 451. The profit was £84,334, which was an advance of £1774. The Directors proposed to pay the usual dividends, and a bonus of 1 per cent.—carrying to the undivided profits £1654. The outlay had been so considerable that they had been unable to make any investments this year. The gas-fittings at Havre, a new condenser and fittings at Nantes, and a new house which they had built for their Manager at Rouen had rather drawn upon their resources; but they might one and all congratulate themselves that they were proprietors in a concern that was so thoroughly sound in every sense of the term. Although perhaps they would not advance by "leaps and bounds," there was every probability that they would do a good, sound business this year, as the returns at present were decidedly satisfactory.

Mr. N. E. B. Garey seconded the motion, which was unanimously adopted.

On the proposition of the Chairman, seconded by Mr. E. T. E. Besley, Q.C., the dividends and bonus recommended in the report were declared.

The Directors retiring by rotation were the Chairman and Mr. Besley; and on the motion of Mr. E. F. White, seconded by Mr. Garey, they were re-elected *nem. con.*

The Auditors (Messrs. J. Reeson and F. M. Fry) having been re-appointed,

Mr. H. E. Jones moved a vote of thanks to the Chairman and Directors for the attention they had given to the interests of the Company.

Mr. Givens seconded the motion; and it was heartily agreed to.

The Chairman, having responded, proposed a similar vote to the officers and staff. He referred to the excellent work which Mr. Williams and his staff did for the Company, and mentioned that the shareholders were especially indebted to the gentlemen who occupied the positions of managers at their various stations. He (the Chairman), accompanied by Mr. Williams, had had the pleasure of visiting them all this year; and, from what he saw, he was certain that no company could have a staff who were more imbued with a desire to do their best for those they served than their own.

Mr. Garey having seconded the motion; it was cordially passed.

A brief acknowledgment from Mr. Williams concluded the proceedings.

AYR AND NEWTON-ON-AYR GAS SUPPLY.

The Rise and Progress of the Gas Companies.

The fact that this year's meeting of the North British Association of Gas Managers is to be held in the town of Ayr—the first meeting of the Association in Ayrshire—would seem to warrant some notice of the gas industry in that town being taken at this time. "Auld Ayr" is situated on the north and south sides of the river of the same name; the portion on the north being called Newton-on-Ayr, in which most of the manufacturing industry is pursued, and where the population is chiefly that of the working class. On the other side of the river are the headquarters of many of the county families, with broad, spacious streets, and many hotels; so that here is the opportunity for a large consumption of gas, which amounted during the past year to 59½ million cubic feet—the make being close upon 67 millions. Our readers may be aware of the fact that within the past year or two the town of Ayr has gone in for the electric light; and those of them who are members of the North British Association and intend to visit the town this week, will have an opportunity of seeing to what extent the new light has laid hold of the shopkeeping class, as also how far the streets are dependent upon it.

Ayr is one of the comparatively few towns of the third-rate order in Scotland where the gas supply is still in the hands of private persons; for in Scotland the municipalizing of the gas supply has made far more progress than it has done either in England or in Ireland. Even in Ayr, efforts have been made in past years to get the Corporation to make overtures to the Directors of the Gas Company to consider the question of selling their works and their interest in the gas supply of the town and district; but up till now nothing has come of their efforts, and the Corporation electric lighting scheme may be regarded as the form which the opposition to the Company has taken. Whether or not the thing is paying or still to pay is one with which we need have no concern. The ratepayers have not yet had anything in their notice papers regarding the electric light; but the burgh rates are creeping up. On the other hand, and notwithstanding the existence of the light in the town, the past year of the gas undertaking was the most successful the Company have ever had, seeing that the shareholders received a dividend of 6 per cent., with a 2 per cent. bonus, and the Company were able to reduce the price of gas 5d. per 1000 cubic feet—from 3s. 9d. to 3s. 4d. The gas shares are rarely offered for sale, unless in the case of deaths or at the

winding up of an estate; but the last report of any getting into the market states that the £5 shares realized £6 15s. 6d. each.

The concern had its origin in the year 1825—the owners being the British Gaslight Company; and the site then occupied by the works is still the same. It is that of the citadel; and on entering the works on the north side the boundary is the wall of what was the citadel or the fort, which is largely covered with ivy. It is probably 200 yards or so from the sea, the boundary of which is an esplanade. Even so recently as January, 1884, the sea made an incursion into the works, and extinguished all the fires, and much of the town was put in darkness. By-and-bye the owners of the works expressed a desire to dispose of them, the cost to any purchaser to be £6000, and entry to be granted on September 1, 1831. Captain J. O. M'Taggart, of Seafield, and a native of Ayr, heard of this desire; and he was the means of securing the works. They were then let at the rate of £350 a year, which with interest, &c., amounted to about £370 per annum. For years the quantity of gas sold was never very large. The Edinburgh Auditor (an Ayr man) thought fit, in view of this year's annual meeting of the Company, to include in his statement a comparison of what its concerns were sixty years ago, when compared with what they had become this year. In doing so, he has brought out many interesting points. There was no detailed balance-sheet available for the year 1836-7 for him to refer to. But he took the year before and the year after, in order to arrive at something like a correct statement for the blank year. He says the sales must have been 1¼ million cubic feet in the first of these two years, and not much over that quantity in the year 1837-8. Some of the gas was sold "without meter," and that sold for the town and harbour lamps together brought in £442. While the sales of 1835-6 must have been less than 2,000,000 cubic feet, those of the following year were probably 2,100,000 cubic feet, and in 1837-8 probably 2,300,000 cubic feet. Now, as we have said, the sales of the past year amounted to 59,500,000 cubic feet, or 28 times greater than those of 1835-6, and 26 times greater than those of 1837-8.

Mr. Cowan, the Auditor, states that the consumers numbered 176 in 1835-6, 187 in 1836-7, and 196 in 1837-8; and in the last mentioned year there were 200 burning without meters. Consequently, one-half of the total number of consumers were in a position of "uncertainty as to their moral integrity." Now, however, the customers are all charged by meter, and not by the irritating system of sixty years ago. In 1835-6, the price of gas was 12s. per 1000 cubic feet, and in 1837-8 it was 10s. Twenty-one years ago, it was down to 5s. 10d., and now it is 3s. 4d. The coal used sixty years ago was 70 per cent. of cannel—or "parrot" coal, as it was called in those days—with 30 per cent. of soft coal. In 1837-8, the proportions were slightly varied; being 73 per cent. of cannel and 27 per cent. of soft coal. But let us see what the yield was. In 1835-6, the sales amounted to 4158 cubic feet per ton of coal carbonized; and in 1837-8, the figure was increased to 4665 cubic feet. In the past year, the gas sold was 7000 cubic feet per ton. The coal used last year was 15 times greater, and the gas sold was 27 times greater than they were sixty years ago. The unaccounted-for gas has now fallen, it is said, to 12 per cent. of the make—reduced from 15 6 per cent. in 1895-6.

The Ayr Gas Company dates back to the year 1845; and since Feb. 1, 1886, it has been a limited liability concern. The capital was then declared to be £40,000, divided into 8000 shares of the nominal value of £5 each. The "Statistical Report on the Gas Supply of Scotland" gives the capital as £36,000; so that there is a want of harmony somewhere. There is a large day consumption of gas in Ayr, where there are numerous stoves, fires, gas-engines, &c.—the latter being in somewhat extensive use by printers, fleshers, bakers, and other tradesmen who wish to have at their service a convenient form of power.

The present Manager is Mr. W. Smith, who had been the Manager of the Newton-on-Ayr Gas-Works. His predecessor was Mr. Robb, son of Mr. John Robb, of Haddington, and President of the North British Association in 1880. Strange to say, Mr. Robb, senr., who is now in his 89th year, was a temporary resident at Ayr last week; and his son, the former Manager, is now permanently resident in the town. He had as his predecessors the late Mr. James Hislop, who was Engineer and Manager of the Partick, Hillhead, and Maryhill Gas Company, and his near relative, Mr. Laurence Hislop.

In the retort-house, the roof of which is at present being raised some 6 feet, there are in all, erected and in course of erection, 72 retorts, worked in a measure on the regenerative system. There are two holders at present in use, both single lift. The newest was put up by Messrs. Hanna, Donald, and Wilson, of Paisley, on the ground of the Citadel Bowling Club. It has a capacity of 240,000 cubic feet, and was installed some three or four years ago. The other has a capacity of probably 110,000 cubic feet. The rest of the plant is fairly well up to the mark—a station meter more especially. The people about the gas-works take delight in showing visitors the relics of the early days of gasholding. Within the grounds there are two store-houses—one round, the other square—in which holders were erected and kept safe from blowing up!

The Newton-on-Ayr Gas-Works, the Manager of which is Mr. James Henderson, formerly of Saltcoats, were established somewhere about 52 or 53 years ago, by a Company, between whom and the Ayr Gas Company there used to be wars and rumours of wars; but these have now all ceased. The fact that it is a working population may be concluded from the circumstance that as many as 120 "penny-in-the-slot" meters have been introduced by the present Manager during the short period he has been in office. He even affirms that he has a bigger population to supply than has Mr. Smith, of the Ayr Gas-Works. He certainly has to supply the suburban villages of Prestwick, Whitletts, and Monkton, the last of which is at least four miles distant from the Newton Gas-Works. Throughout his district, he has some 24 miles of street (or road) mains. During the five years that Mr. Henderson has been Manager, the capital of the Newton-on-Ayr Consumers' Gas Company has doubled, and now stands at £20,000; and in the same period of time the make of gas has increased to 32 million cubic feet, or more than 50 per cent. The leakage at Newton-on-Ayr stands at 18½ per cent., to which it has been reduced from 30 per cent. since Mr. Henderson entered upon his duties as Manager five years ago. He is understood to supply his consumers with 24-candle gas, which is made by his own regenerative system, which has been adopted by managers elsewhere. He is at present engaged in the erection of a new bench of retorts. Peace now reigns between the two Companies—the Ayr Company confining their attention exclusively to their own side of the river; and both charge the same price.

ACCIDENT AT THE BURY CORPORATION GAS-WORKS.

A Man Suffocated in a Tar-Still.

On the 9th inst., Squire Thomas Barlow met with his death in the tar distillery attached to the Bury Corporation Gas-Works, under circumstances related at the inquest, held the following Monday morning. John Burgess, who was working with deceased on the day named, stated that they were engaged in chipping off a crust of pitch at the bottom of the tar-still. When they started at 8.30 in the morning, the still seemed free from gas; but they came out two or three times before 10 o'clock for fresh air, as they usually had to do. As they worked on, the atmosphere in the still became worse; but they made no complaint about it. The foreman visited them once or twice; and they told him they were going on all right. The foreman and Malone (the stillman) came to them a few minutes before deceased died. Shortly after 11 o'clock, witness, who was working in the still alone, had to come out, owing to a feeling of being suffocated. The deceased was then outside; and the foreman directed them to go to the office and remain there a little time. Deceased and witness did not, however, do so, but stayed on the top of the still; and a few minutes later Barlow went down the ladder in the still to loosen the outlet-pipe. Witness, however, warned him that "it was bad." He got to the bottom, but immediately returned; falling back again on reaching the top. A rope was fastened round Malone, who went down the ladder, but had to retreat before he could get to deceased. Malone gave evidence to the effect that deceased had worked at the tar distillery close upon two years, and from time to time had cleaned out the stills. He believed gas was thrown off from the chippings; but it was unnecessary to obviate that as the men could leave the still immediately. The Engineer (Mr. W. H. S. Gendall) had given instructions that every possible part of the still should be opened before commencing work. Barlow was in the still about twenty minutes. Mr. Gendall was called. He said he had had complaints about a smell being thrown off by the chippings, and had given instructions for every outlet to be opened before the men went in. A steam-jet should have drawn off all volatile gases. It might be possible to force fresh air into the still by means of a blacksmith's bellows or a fan worked by hand. The gas emitted was sulphuretted hydrogen; and his explanation as to it accumulating in the still was that it was retained in blisters in the pitch. The medical testimony was to the effect that death was due to asphyxia, caused by poisonous gas. Mr. Herbert Porter, an Inspector under the Alkali Works Regulation Act, deposed that, so far as his inspection went, there was no evidence of gross negligence on the part of anyone. The jury returned a verdict of "Accidental death;" a juror remarking that, to a great extent, the deceased was responsible for his own death, as he had entered the still after he was warned not to do so.

BIRMINGHAM CORPORATION GAS SUPPLY.

Wages and Labour at the Gas-Works—Mr. Hack's Salary.

The Quarterly Meeting of the Birmingham City Council is fixed for to-day; and in the report which will be presented by the Gas Committee, the question of labour and wages at the gas-works is dealt with. It is stated that in February last the Committee received an application for a revision of the schedule of wages and work which was agreed on between the Engineers and representatives of the men on the adoption of eight-hour shifts in 1889. The Committee ascertained that the additional cost of the suggested reduction of work and increase of wages would amount to about £18,750 per annum. After several interviews with the representatives of the men, in the course of which it was found that there were branches of the work in which the conditions had changed, the application was referred to the Engineers, with instructions to discuss it with the men, and report their recommendations to the Committee. After prolonged consideration, the Engineers submitted, and the Committee approved, an amended schedule of work and wages, to come into operation as from the close of the manufacturing week ending the first week of August. The estimated annual cost of the reduction of work and increased wages provided for in this amended schedule is about £9000. The workmen affected by the changes are, with the exception of the yardmen, whose wages are proposed to be increased to 22s. per week, all engaged in work special to gas-works.

In connection with the discussion of the above subject, the Committee have authorized an expenditure of £1390 on an additional pair of drawing and charging machines at Windsor Street works, so as to reduce the distance over which the machines have to be moved, and the provision of pipes for the application of steam to the clinkering of regenerative furnaces. They have also sanctioned the expenditure of £1183 in the provision of a third locomotive engine, and an additional weighing-machine and house at Windsor Street, so as to completely separate the coke from the coal traffic within the works.

The Committee further report having received a renewed application from Mr. Hack for an increase in his salary. He was appointed to succeed the former Engineer of the Birmingham and Staffordshire Gas Company before the transfer to the Corporation in 1876. At the time of Mr. Hack's appointment, the former Engineer to the Company was paid a salary equivalent, with allowances, to £1350 per annum; and the output of gas from the works of the Company was then 1705 million cubic feet. At the time of the transfer of the undertakings, Mr. Hack's salary was, inclusive of allowances, equal to £700 per annum; and he accepted his appointment under the Corporation on the assurance that they would remunerate their chief officers on as liberal a scale as that of the Companies transferred. Mr. Hack's present salary is £1050; and the output of gas from the works at Saltley and Swan Village under his control was last year 2811 million cubic feet, representing a carbonization of 280,000 tons of coal. From 1875 to 1882, his salary was voluntarily increased from time to time to £900 per annum. In 1883, his house at Saltley was required for an extension of the offices; and his allowances in the shape of rent, coal, gas, &c., were commuted by increasing his salary to £950 per annum. In 1889, his salary was raised to £1050 per annum. But the payment by the Committee of income-tax on his salary, as in the time of the Companies, was discontinued; and the practical effect of these two changes has been that his

salary has not been increased in value since 1882 by more than £40 per annum. Since that date, he has effected many valuable changes in the method of manufacture, and has carried out important extensions of the works, involving considerable expenditure, without additional remuneration. The effect of these changes and additions has been to make the Saltley works one of the cheapest of the manufacturing stations of the Corporation; and the Committee are aware that the cost of manufacture there compares favourably with most of the large manufacturing works throughout the country. The daily productive capacity of the Saltley works alone is now above 12 million cubic feet; it having been more than doubled since the transfer. The Committee feel that the time has now arrived when Mr. Hack's claims should be recognized. It was a matter of disappointment to them that the recommendation made by them in 1895 in Mr. Hack's favour was not adopted by the Council—a result which they believe would not have been arrived at had the Council possessed the intimate knowledge which the Committee have of the value and fidelity of Mr. Hack's long and unvaryingly successful services to the department. They therefore unanimously and earnestly recommend the Council to increase his salary to £1200 per annum, as from the 1st inst. The salary of Mr. Hunt, the Engineer having charge of the Windsor Street and Adderley Street works, was increased to £1200 per annum in 1888. Much larger salaries are usually paid by similar undertakings to Engineers than that now paid to Mr. Hack; and in more than one instance former pupils of the Engineers to the Department are in receipt of such salaries elsewhere. At Leicester, for instance, where the annual output is under 1350 million cubic feet, the salary paid to the Chief Engineer is £1250; and at other important works in the country, in some of which the annual output is not larger than from the works under Mr. Hack's charge, the salaries range from this amount to £2500 per annum or upwards.

NOTTINGHAM CORPORATION GAS SUPPLY.

Annual Reports and Accounts.

We have received from the Engineer and General Manager of the Nottingham Corporation Gas-Works (Mr. W. R. Chester, M.Inst.C.E.) a copy of the reports and accounts of the department for the year ending March 31 last.

The Gas Committee in their report state that the net profit for the past year was £28,779 17s. 2d. Adding £37 10s. 6d. brought forward, made £28,817 7s. 8d. Of this sum, in accordance with the orders of the Council, £27,000 would be paid to the Finance Committee—viz, £24,000 in aid of the current rate, and £3000 to the order of the Mayor for the expenses of the local Jubilee celebration; leaving a balance of £1817 7s. 8d. to be carried to a fund for the redemption of annuities. The price obtained for both sulphate of ammonia and coke was still very low, and these products were difficult of sale; the total decrease on the residuals being £4712 8s. The quantity of gas made was 1,673,714,000 cubic feet, as compared with 1,586,434,000 cubic feet in 1895-6; being an increase of 87,280,000 cubic feet.

Following the Gas Committee's report, is one by Mr. Chester on the works and manufacturing operations. He states therein that the plant, machinery, and buildings at the various works were kept in good repair during the year, and that their efficiency was fully maintained. The carbonizing machinery at the Basford station made a very satisfactory start. It was put into operation in November, 1895, and ran continually until March, 1897, when the retorts had to be let down for renewal. During this period the machinery dealt with 57,000 tons of coal, though it was only employed up to about half its proper capacity. A further section of regenerators will be completed during the present summer; and when these are put into operation, as well as those which are now under repair, the machinery will for the future be employed up to its full capacity. The continual growth in the demand for gas for cooking, heating, and motive purposes, renders it necessary to make frequent enlargements in both mains and services; and special attention was paid to the distributing plant during the past year, with the result that there was a small, though gratifying, decrease in the quantity of gas unaccounted for. The average illuminating power of the gas for the past year was 18·97 candles, and the sulphur compounds were kept down to 21·09 grains of sulphur per 100 cubic feet. In the distribution department, 3·78 miles of mains were added during the year; bringing up the total to 290·45 miles. The number of meters fixed at March 31, 1897 including 347 lamp meters), was 41,602; being an increase of 1263 on the previous year. Of these, 39,219 belong to the Gas Department; and 2383 to the consumers. The demand for prepayment meters continues to increase. At the end of the financial year, 4273 of these meters were in operation—an increase of 1022. The orders and calls for attention of various kinds from consumers was 42,067, against 38,931 for the previous year; and 1602 new gas services were laid, as compared with 1320. The application of gas for trade and domestic purposes, other than for lighting, extends. There are at present in use about 4500 gas cooking-stoves, about 4770 gas-fires, and 377 gas-engines, besides a very large number of other appliances of almost every description, which have not been numbered. Of the 4500 cookers in use, 4149 are rented from the department.

Accompanying the reports are the financial and working statements. From the former we find that £9691 was spent on capital account last year, chiefly for new mains and service-pipes, meters, and stoves; bringing up the total expenditure to £1,015,221. The revenue from the sale of gas to private consumers amounted to £180,258; from public lighting, to £9500; the rental of meters and stoves amounted to £7895; residuals produced £42,602; and sundry receipts made up a total of £244,920. The outlay on the manufacture of gas was £127,888 (£75,187 being for coal, and £23,825 for repair and maintenance of works and plant); distribution cost £21,970; rents, rates, and taxes came to £11,406; management cost £6531; and the total expenditure was £168,269—leaving a balance of £76,651 to go to the profit and loss account. After paying interest, &c., there was left a net balance, as above stated, of £28,779. With regard to manufacturing operations, the quantity of coal carbonized was 159,550 tons, as compared with 152,656 tons in 1895-6; the bulk of gas made being 1,673,714,000 cubic feet, of which 1,572,699,400 cubic feet were sold and 101,014,600 cubic feet unaccounted for, or 6·04 per cent. Last year the quantity of gas made was 1,586,434,000 cubic feet; sold, 1,486,123,700 cubic feet; and unaccounted for, 100,310,300 cubic feet, or 6·32 per cent. The residuals produced were: Coke and breeze, 94,348 tons (including 1711 tons of Wollaton ash); tar, 2,107,689 gallons; ammoniacal liquor, 4,187,310 gallons. The receipts per ton of coal carbonized came to 30s. 8·42d., and per 1000 cubic feet of gas sold to 3s. 1·38d.; the expenditure being 21s. 1·12d. and 2s. 1·68d. respectively.

The reports were adopted by the Council on Monday last week.

ELECTRIC LIGHTING NOTES.

Last Tuesday, the Coventry City Council considered an important report from the Electric Light Committee. The Committee sought the Council's sanction to an application to the Local Government Board for a loan of £37,900, for the provision of a steam alternator at the works (which, with the necessary alterations, would cost £8000), to lay mains along 50 streets, with a total length of 7½ miles, and to light with 40 lamps 14 of the chief streets in the city. The Chairman of the Committee (Alderman Hill), in proposing the adoption of the report, stated that the present works would supply between 7000 and 8000 8-candle lights; and there were already applications for more than 8000 lamps. He argued, from what the Council's deputation saw at Portsmouth, Reading, and Newport (Mon.), that electric lighting ought no longer to be regarded as an experiment. Mr. West seconded the proposition; remarking that the history of the department showed that the business was steadily growing. The mileage at present was too small for them to make a profit; but it was believed that, with the proposed extensions, the rates would in time be substantially assisted. In the discussion that ensued, one of the chief arguments used against the recommendations was the selection of the streets for the mains. Mr. Russell agreed with the principle of keeping pace with the times; but he asked whether the ratepayers could keep pace with the rates. He was of opinion that the Committee should have shown a profit before bringing forward further extensions; while Mr. Lee, who proposed, as an amendment, that the report be referred back to the Committee, classed the Coventry system as extravagant. The amendment was seconded by Mr. Webb. Mr. Gorton said he was desirous of knowing if the Committee would come in twelve months' time for a further £30,000, and then say possibly there might be some return. Alderman Hill, in reply, mentioned that the proposed extensions would increase the capacity of supply from 7500 to 17,000 8-candle lamps. On the question being put to the vote, there was an equal number for the amendment and the original proposition. The Mayor (Alderman Tomson) gave his casting vote in favour of the recommendations, on the understanding that the list of streets should be reconsidered. In the end, the Council adopted a proposal to adjourn the consideration of the question until the next meeting, which will be held in a month's time.

It was briefly announced in the "JOURNAL" last week that the Bridgwater Town Council had decided to apply for a Provisional Order to enable them to carry out a scheme of electric lighting on the low-tension system. The decision was come to at a meeting at which a long report by a Sub-Committee of the Lighting Committee was presented. In commencing their investigations, they inspected works on the high-tension system at Tunbridge Wells, Kingston-on-Thames, Bristol, Taunton, and Newport (Mon.); and on the low-tension system at Harrow, Brighton, and Pontypool. They then proceeded to draw a plan of the borough, and to mark off sections by rings 100 yards apart, with the Town Bridge as a centre. It was found that a radius of 1200 yards embraced the whole of the borough, while one of 700 yards included the public buildings, principal shops and hotels, and chief business portions of the town. The Sub-Committee recommended that the three-wire low-tension continuous-current system, with accumulators, should be selected. With regard to lamps, arcs of 2000-candle, and incandescents of 16-candle power were suggested; and it was reckoned that 27 of the former and 250 of the latter would suffice. To simplify their calculation, they assumed that 854 8-candle incandescent lamps would be wanted, which would require 240 Board of Trade units per night, calculated on the average length of time the gas-lamps are now lit—viz., 9·17 hours per night. Coming to the power necessary to develop this amount of light, it was thought that plant equal to serving 2000 8-candle lamps should be provided. The Sub-Committee prepared two estimates—one, covering the public lighting in the centre area of the borough, of £14,672; and the other, embracing a more restricted area, of £10,984. Making these sums into round figures, they took £14,700 and £11,000, and proceeded to estimate the standing charges; the capital to be repaid, at 3½ per cent. interest, in 25 years. For the full scheme, they reckoned £892 for interest and sinking fund, and £745 for working expenses; making together £1637. For the restricted scheme, they put the repayment of principal and interest at £668, and the working expenses at £676; making together £1344. The present lighting of the borough costs £892, with £119 additional for the public buildings—together, £1011. Passing on to the question of price, which was worked out on the Brighton system, two illustrations were given to demonstrate that electricity will be cheaper than gas; and then the Sub-Committee proceeded to show the effect on the station, assuming a load of 2000 private lamps. They reckoned 61 units, at 7d. per unit, for 365 nights, £649 7s.; a like number at 2½d. per unit, £231 18s. 6d.; and the income from public lighting, £891 15s. 6d.—making a total of £1773 1s. As already mentioned, the total outgoings will be £1637; so that there will be a surplus of £136. The margin is remarkably small. Nevertheless, the Council have decided to go on with their scheme.

Fatality at the Higginshaw Gas-Works, Oldham.—While some coal-waggons were being sent down the siding at these works on the 16th inst., the man in charge lost control of them, and they dashed into a lurry which was standing in the way. Just at the moment, William Baxendale, an old servant who had formerly been Manager of the works, was passing between the lurry and the weigh-house—not having heard the alarm which had been given—and was crushed, and his body forced through the window. He was killed on the spot; and the house was much damaged by the force of the impact.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Past Year's Work—The Council and the Water Commission.

At the Meeting of the London Council last Tuesday, the Chairman (Dr. W. J. Collins) delivered his address on the work of the Council during the year ended March 31. Referring to the water supply of the Metropolis, the Chairman remarked that the Council could not be accused of undue precipitation in applying to Parliament for the necessary powers to carry out the scheme of the Chief Engineer (Sir A. R. Binnie), endorsed by the Water Committee, for bringing from the hills of Wales an uncontaminated and ample supply of soft water to augment the future needs of London. Now that Sir Benjamin Baker and Mr. Deacon had practically confirmed the conclusions of their Engineer, progress would doubtless be accelerated, in view of the admission on all sides that further delay might be perilous to the health and interest of the Metropolis. A wide diversity in reports of analysts on the amount of suspended matter in water supplied by the various Companies led the Committee to instruct the Chemist to continue his investigations by micro-filtration. While it was difficult to assess the relative merits of chemical and bacteriological analyses as determining the potability of any water, presumption in favour of one from an uncontaminated source, as against one "initially polluted, and subsequently more or less purified," might perhaps be justified on stronger grounds than sentimental prejudice. The Chairman also alluded to the subject of water supply in the course of his remarks on the work of the Parliamentary Committee, whose report dealt mostly with Water Bills. He said it recorded the fate of the Metropolitan Water Board Bill of the Government, which passed the Lords, but was not proceeded with in the Commons. The Bills of the Water Companies which were before Parliament last session contained proposals for raising an aggregate of £4,300,000 additional capital. They were petitioned against by the Council, and referred to a Parliamentary Committee. Ultimately the capital powers granted by Parliament amounted to £1,930,000. The Select Committee to which the Companies' Bills were referred put on record the following important opinion, from which few would be found to dissent. They stated that "the present position of the London Water Supply is not in accordance with the public interest," since, "under the conditions of issuing new capital now invariably approved by Parliament for the London Water Companies, the public is steadily acquiring an interest which tends to weaken the enterprise of the Companies as private concerns, while, on the other hand, the consumer is left without that care of his interests which is ensured by placing the supply under a representative body in whose election he is personally interested." One mode of escape from this anomalous and unsatisfactory dilemma was offered by the Water Purchase Bills promoted by the Council. These Bills, however, were opposed on second reading in the House of Commons by the President of the Local Government Board, on behalf of the Government, and rejected by 258 votes to 123. The alternative procedure indicated on that occasion by the Government was the appointment of a small Royal Commission, and the introduction of a Bill intended to give some further powers of complaint to aggrieved water consumers.

At a subsequent stage of the proceedings, the debate commenced at the previous meeting (*ante*, p. 180) was resumed upon the report of the Water Committee, submitting certain resolutions on the London Water Question which they asked the Council to pass as a guide to the Council's witnesses in the evidence they should give before the Royal Commission on London Water Supply. The first resolution was—"That, in the opinion of the Council, the water supply of the Metropolis should not continue in the hands of private Companies." Dr. Longstaff moved an amendment to make the recommendation read—"That, in the opinion of the Council, the water supply of the Metropolis should not continue wholly in the hands of private Companies, but should be under effective public control." Dr. White seconded the amendment. Mr. M'Dougall asked leave to make a personal explanation with reference to certain remarks he had made at the previous meeting, as to an alleged contamination of water in the Thames in the neighbourhood of Goring. He observed that water from this spot had been examined by the Chemist to the Thames Conservancy, and had been found to contain no sewage or mineral contamination. Its discoloration was due to certain water plants, and would disappear before the water reached the intakes of the London Water Companies. After some discussion, a division was challenged; but the amendment dropped, and the resolution was agreed to. The next resolution submitted was—"That, in the opinion of the Council, the undertakings of the Metropolitan Water Companies should forthwith be purchased at the fair and reasonable value of the same; regard being had to the rights, special circumstances, and obligations of the Companies." Mr. Porter moved, as an amendment—"That, since the purchase of the undertakings of the Metropolitan Water Companies would probably increase the cost of water to the public, the Council should not pronounce an opinion in favour of such purchase pending inquiry by the Royal Commission. Mr. E. White seconded the amendment. Mr. Westacott and Sir J. Lubbock, M.P., supported the amendment, which was opposed by Mr. Dickinson. At seven o'clock, the debate not being concluded, the Council transacted unopposed business, and shortly after adjourned.

LIVERPOOL CORPORATION WATER-WORKS.

Last Wednesday, the Water Committee of the Liverpool Corporation made their annual inspection of the various pumping-stations of the district and the reservoirs at Prescot. The occasion was of more than usual importance in consequence of the recent development of the water supply system; and an added interest was given by the fact that this is the Jubilee year of the Corporation Water-Works; it being fifty years since the undertaking was purchased of the private Company who supplied the city and district with water. The first place visited was the pumping-station at Everton, the feature of which is a new and powerful engine, the first of its kind designed and constructed in England. It was built by Messrs. Hathorne, Davey, and Co., of Leeds, and is a fine illustration of the high standard attained by present-day engineers. By a happy custom of the Water Committee, the engines are named after the various Chairmen; the last one being christened the "William Radcliffe," after the present Chairman. An interesting function was performed in the engine-house, when the Lord Mayor (Alderman Thomas Hughes) set the engine in motion. In performing the duty, his Lordship referred to the wonderful advance that had taken place in the construction of machinery for pumping water, as was illustrated by the various engines at the station. Alderman Radcliffe expressed his thanks to the Lord Mayor. The erection of the engine marked the completion of a scheme, divided into seven portions, which had occupied the attention of the Committee for some years. For the total scheme, an expenditure was estimated of £149,100; but the actual sum spent had been £113,004, or £36,096 less. This reflected much credit on their Engineer (Mr. J. Parry). The party afterwards proceeded to the works at Green Lane, where the chief object of interest was an old pumping-engine erected in 1837 at Bootle, and removed to Green Lane in 1856. The engine is not now in use. Prescot was the next point; and here the party was received by Mr. John Kirby, Superintendent of the station and reservoirs. The works at Wavertree were subsequently inspected. The company had luncheon together at Prescot; a feature of the after proceedings being the presentation of a gold key to Alderman Radcliffe, in commemoration of the opening of the new service reservoir at Breeze Hill, Walton, in March last, on which occasion he was unable to be present owing to ill-health.

WATER-WORKS IN JAPAN.

We have it on the authority of "Engineering" that one of the reasons which induced the Japanese to propose that their currency should be placed on a gold standard, was that they might bring their country within immediate reach of the stores of cheap capital awaiting investment in the Occident; and already schemes are being formed for the attraction of that capital to Japan. Within the past few years, a great deal has been done in the way of supplying water to the chief towns in Japan; but a great deal more requires to be accomplished. The Kobe Municipal Council have decided to supply the town and district with water; and as a first step the raising of loan bonds was publicly announced in the foreign and Japanese papers. These bonds will be paid off by lottery, extending over a period of 45 years. The scheme has been under consideration for some time. Plans were prepared in 1892; and the cost was estimated at 970,000 yen. But as time went on, the scheme was enlarged; arrangements being made to supply water to 250,000 persons, with possible extensions to a much larger number. In consequence of these developments, and the great increase in prices, the estimates for the work rose to 3,290,000 yen; and in February last the plans and estimates were approved by the Municipal Council, and the works were commenced the following month. The quantity of water to be supplied per day per individual is estimated at upwards of 18 gallons. Though it is intended in the end to utilize the streams of the Nunobiki, Saido, Tenivo, and Karasubara, at present only the first and last will be tapped. At the junction of these streams, reservoirs will be constructed, and filter-beds erected. When the works are completed, the rates of payment in the settlement will be: For 20,000 gallons per month, 4 yen; more than 20,000 gallons per month, a reduction of 20 sen per 1000 gallons; when the use exceeds 100,000 gallons per month, a still greater reduction will be made. These works are being designed by, and constructed under the superintendence of, Japanese engineers; but the greater part of the pipes and fittings will require to be imported, probably from England.

Deal Water Company.—The annual general meeting of this Company was held last Wednesday, when it was stated that the gross income amounted to £4084, and the expenditure to £1516—leaving a balance of £2568; being an increase of £302 in the year. The balance to the credit of the dividend and interest account was £3760, out of which the Directors recommended dividends of 10, 7, and 5 per cent. on the various classes of shares. Since the shareholders last met, the local authorities of Deal and Walmer have promoted a Joint Bill for the compulsory acquisition of the Company's undertaking. The Directors opposed certain clauses; and the promoters offered to amend the Bill so as to meet the objections raised. It is now only a question of time for the undertaking to be acquired by the two authorities jointly. The Bill provides for the sale and purchase of the undertaking at a price to be agreed upon, or, failing agreement, by arbitration in the mode provided by the Lands Clauses Act.

The Testing of Gas and Meters by the London County Council.—In his address last Tuesday on the work of the London County Council during the past year, the Chairman (Dr. W. J. Collins) referred to the testing of gas and meters, which is carried on under the supervision of the Public Control Committee. He said that, in the matter of gas testing, the old candle standard has been found unsatisfactory, and a Board of Trade Committee reported two years ago that the 10-candle pentane argand standard should be substituted for it. The Law Officers of the Crown advised that the Gas Referees could prescribe the new standard without legislation. Subsequent information, however, indicated that the Referees deemed it necessary to introduce a Bill. No progress appeared to have been made either by prescription or by legislation, and the daily testings were going on with the old variable and unreliable standard, to the disadvantage of the consumers. Tests made with the portable photometer, though unrecognized by law, continued to show that a large amount of the gas supplied at other than the testing-stations was considerably below the statutory requirement of 16-candles. The Chemist (Mr. W. J. Dibdin, F.I.C., F.C.S.) concluded, from the investigations he had made, that "the effect of the present system of enrichment is partial, and confined to the proximity of the testing-places." More than 180,000 gas-meters were stamped last year at the Council's three offices. It was a pity that the Council's testing was limited to verifying the measuring capacity of the meter as shown on the unit index, and did not extend to a verification of the multiplying wheels of the recording apparatus. Penny-in-the-slot meters continued to be received in large numbers. The fees taken in this department of the Council amounted to about £6000 per annum, and more than covered the expenses.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Directors of the Coatbridge Gas Company, in the report which they will submit to the shareholders next Tuesday week, state that the total revenue in the six months ending June 30 was £7370. The expenditure being £4422, the balance carried to the profit and loss account is £2948. Of this sum, £172 is chargeable for interest, and the remainder, added to the amount brought forward (£950), makes a sum of £3726 applicable for division. Dividends at the rates of 10 and 7 per cent. per annum on the old and new stocks will be recommended. Under the supervision of Mr. T. Wilson, the Secretary and Manager, there were 3954 tons of coal and 1120 tons of shale carbonized in the half year; and 1976 tons of coke, 205,000 gallons of liquor, 61,633 gallons of tar, and 3250 gallons of naphtha were produced—the liquor being converted in sulphate of ammonia. The quantity of gas sold was 5,300,011 cubic feet more than in the corresponding period of 1896; the number of consumers having increased by 142. The consumption through ordinary meters was 35,486,900 cubic feet; and that through the agency of prepayment meters, 2,724,877 cubic feet. The Company intimate that they have, as from the 1st inst., reduced the price of gas from 2s. 11d. to 2s. 6d. per 1000 cubic feet. Whereupon a newspaper published in Airdrie, takes to demanding that the Gas Company in their town shall also supply gas at this price. There is nothing unreasonable in asking the question why it cannot be done, though there might be many explanations why the answer might be given that it is not possible. But the sapient writer of this article, giving rein to his imagination, runs off into the line of contemplating the time when they will be able to light their districts by means of burning the refuse of the town. Lord Kelvin has blest an adventure of this nature at Shoreditch; and why should it not be introduced into Airdrie? Some people have too much imagination, and a total disregard for actualities. If this Airdrie solon had cast his mind's eye back not more than five years, he would have had presented to him the spectacle of the learned Lord Kelvin, in a similar manner, blessing an adventure in Coatbridge which was to provide light for almost nothing by electricity generated by means of gas-engines driven by water gas. This venture was a short-lived one, because it was found that water gas was not of the same value as a motive power as coal gas, and the whole of the calculations were out. Great scientists are sometimes persuaded to lend their aid to schemes which are not altogether logical, not to say possible; and, judging by the Coatbridge experience, on the ground that an ounce of fact is worth a ton of theory, though Shoreditch has got a magnificent send-off in the matter of producing light from town's refuse, it may be a long time before the municipality of Airdrie will be able to light the editorial room of this newspaper by the consumption of the contents of the scavenger's cart.

The finances of the Paisley Gas Trust, for the year ending May 28, have been put out this week. The gross revenue was £40,686, and the gross expenditure £33,629; the balance of profit being £7057. Out of this sum, the following provisions have been made: Interest on mortgages, &c., £2203; sinking fund, £605; and contingent account, the balance of £4312. The Town Council resolved to retain the price of gas at 2s. 6d. per 1000 cubic feet. The accounts do not show much change. The revenue is £500 more than a year ago, the expenditure is £1824 more, and the surplus is £1324 less.

The Greenock Corporation Gas Committee in their last financial year earned a revenue of £40,295, and expended £31,876; having thus a balance of profit amounting to £8418. After meeting extraordinary expenditure and charges for interest, there remained a net surplus of £226. The surplus estimated was £178. Bailie Mitchell, at a meeting of the Police Board this week, stated that the expenditure upon coal had been above the estimate. They had had to pay 1½d. per ton more than was anticipated; and this worked out to about £400.

The annual meeting of the Montrose Gaslight Company was held on Wednesday. The Chairman (Mr. Arthur Dickson) stated that during the year ending May 31, 2758 tons of coal were carbonized, which yielded 29,057,000 cubic feet of gas. The consumption of gas was nearly 700,000 cubic feet more than in the preceding year. The average illuminating power was 25 candles; and the unaccounted-for gas amounted to about 12 per cent. The four purifiers which had been in use for many years were at present being replaced by larger ones, at a cost of over £800. All the other parts of the works were in excellent order. The income for the year amounted to £6011, and the expenditure to £4693; leaving a balance of £1317. A dividend at the rate of £2 10s. per share was declared.

The estimates for the lighting of the city of Edinburgh for the current year have been prepared. They amount to £32,960, as against an actual expenditure last year of £30,063. Less than ten years ago the estimate was about £14,000.

The Directors of the West Kilbride Gas Company have declared a dividend of 4 per cent. When the recent alterations and improvements at the works are taken into account, the result is considered to be very satisfactory.

The annual meeting of the shareholders of the Berwick and Tweedmouth Gaslight Company was held at the Corn Exchange, Berwick, on Wednesday. The annual report, which was read by the Secretary (Mr. T. G. Turner), showed that the net profit realized during the year was £1180; and a dividend at the rate of 10 per cent. was declared. The Directors having placed contracts for the supply of parrot coals for the current year on favourable terms, announced a reduction in the price of gas from 3s. 9d. to 3s. 8d. per 1000 cubic feet. The amount received for gas sold during the year was £4983; for use of meters, £121; and for coke, tar, lime, &c., £541. The report was adopted.

The revenue of the Paisley Water Trust for the past year amounted to £23,173, and the expenditure to £21,178, which left a balance to the good of £1995. The Corporation have fixed the water-rate for the current year at 7d. per pound.

The Falkirk and Larbert Water Trust had their accounts for the past year before them this week. Bailie Hamilton, who presided, said that they had had a very successful year as a Trust. They began the year with a credit balance of £516; and they had finished it with a balance of £958. They had taken 2d. per pound off the rates; and he would not be surprised though they should be able to take off another 3d. The accounts were ordered to be printed; and they are to come up again for consideration.

The Town Council of Peterhead, as Water Trustees, have had a new reservoir, of over 2 million gallons capacity, constructed at Forehill, some 2¼ miles from the town. The cost has been about £2000. The reservoir was formally opened last Tuesday, by Provost Smith; the ceremony taking place as part of a general inspection of the burgh water-works.

The following appeared in a Glasgow newspaper the other day: "Stirling is at the present time considering an oft-mooted proposal to erect a bridge across the Forth at Cambuskenneth Abbey; and there is a prospect of the scheme being carried through on this occasion, thanks partly to the city of Glasgow. In the Corporation Water-Works Act of 1895, the city became bound, so soon as a quantity of water exceeding 50 million gallons a day was drawn from Loch Katrine, to pay the Forth Navigation Trustees a sum of £4500 in three yearly instalments. On May 22 last, this condition became operative; and next November the first instalment must be paid. The Act of 1895 empowered the Navigation Trustees to contribute £1500 of this compensation towards the erection of a bridge at Abbey Ford; and as the money will be in their hands in less than four months, there is a strong feeling in the historic town that the movement for a bridge should be carried to a successful issue. The bridge would give a great impetus to feuing on the Abbey grounds, and enable the authorities to lay out a fine carriage-drive to the ancient Abbey and the Wallace Monument."

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 24.

Sulphate of Ammonia.—The market continues without special feature—the quotations being £7 8s. 9d. to £7 10s. per ton f.o.b. Leith, £7 10s. per ton f.o.b. Hull, and £7 11s 3d. to £7 12s. 6d. per ton f.o.b. Liverpool. Demand remains moderate, and is mostly to cover contracts—buyers abroad being for the most part unwilling to pay the equivalent of U.K. quotations. There have been more parcels offering on the West Coast; but makers generally decline to give way in the matter of price. In the forward position, the weak nitrate of soda market has impressed sulphate of ammonia buyers; and it is now difficult to obtain any premium for delivery over the autumn months. For spring, there would still be buyers at a small premium.

Nitrate of Soda is quiet in all positions. On spot, the quotations are 7s. 4½d. per cwt. for ordinary, and 7s. 6d. per cwt. for fine quality. For spring delivery, Hamburg quotes equal to 7s. 6d. per cwt., U.K. terms.

LONDON, *July* 24.

Tar Products.—The slackness noted in benzols in last week's report has accentuated itself during the past week. The position to-day is undoubtedly weaker. There is, however, no cause for disquietude, as stocks in all hands are extremely low. Pitch continues to hang, and is a source of great solicitude to distillers; the outlook being far from encouraging. It is such an important element in the value of tar, that it is not surprising producers are anxious about its position. Very little new business is reported in any products; and the only bright feature of the market is the excellent demand for creosote and heavy tar oils. There is a sudden collapse in the value of naphthalene, which at the moment yields less than it could be sold at in the form of creosote.

Business during the week has averaged the following prices: Tar, 16s. to 20s. Pitch, 19s. to 21s. Benzols, 90's, 2s.; 50's, 2s. Toluol, 2s. 1½d. Solvent naphtha, 1s. 7d. Crude, 30 per cent. naphtha, 11½d. Creosote, 2½d.; liquid, 3d. Heavy oils, 42s. 6d. Carbolic acid, 60's, 1s. 10d. Pressed naphthalene, 40s. Creosote salts, 20s. Anthracene, "A," 6d.; "B," 5d.

Sulphate of Ammonia keeps steady; and a fair business is being done at £7 7s. 6d. to £7 11s. 3d., according to port of delivery, less 3½ per cent.; while for next season's requirements, £8 is asked.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Practically the whole of the gas coal contracts of any importance for the ensuing season have now been placed; and it may be taken that, with very few exceptions, the prices which colliery owners have had to accept have been based on those which were ruling last year. This gives an average of about 6s. 3d. to 6s. 6d. per ton at the pit for the commoner qualities, such as Wigan four-feet, and 7s. to 7s. 3d. for the better descriptions, such as Arley gas coal. The locomotive fuel contracts have also been settled on much the same basis; 5s. 9d. per ton at the pit being the average figure. The season has consequently been disappointing to colliery owners, who, at the outset, were undoubtedly anticipating that some better prices would be obtainable. In many tenders advanced prices were sent out; but only in very isolated cases have colliery proprietors been successful in securing business except where they have been prepared to take last year's rates. Much the same efforts were made with regard to the locomotive fuel contracts; but with similar want of success. In house-fire coals, there has also been an effort to raise prices about 3d. per ton, to cover the anticipated increased charges that will be thrown upon colliery owners by the Workmen's Compensation Bill; but the breakdown of expected Yorkshire co-operation has rendered this practically a failure. The prices which are just now actually being got in the market do not average more than 9s. 6d. to 10s. per ton for the better qualities of Arley; 8s. to 8s. 6d. for Pemberton four-feet and seconds Arley; and 6s. 6d. to 7s. for common house coals. A tolerably active demand for shipment, and briskness in the principal coal-using industries, have given a steadiness to the common classes of round coal; and prices 6d. per ton above the minimum figures taken last year have been obtainable. Pit rates for inland sales are quite 6s. to 6s. 3d. per ton, with 7s. 6d. up to 8s. obtained readily for ordinary steam coals delivered at the ports on the Mersey. Common slack however has established itself at about 3s. 3d. to 3s. 6d. per ton; medium sorts, 3s. 9d. to 4s. 3d.; and best qualities, 4s. 6d. up to 5s.

Northern Coal Trade.—There has been a fair amount of activity in the coal trade of the North; and the strike of the engineers has had as yet little effect, apart from a reduction of the request for manufacturing coals in a few instances. The exports generally are continuing large; and thus there is a fair general demand for fuel. Best Northumbrian steam coals are steady at from 8s. 7½d. to 8s. 9d. per ton f.o.b.; second qualities are about 8s.; and steam smalls are 3s. 6d. to 3s. 9d. Manufacturing coals are duller, from the cause already named. The gas coal trade has gained a little strength; and the shipments are fuller, as well as the home and local consumption. A few small contracts have been concluded, at prices that may be taken as averaging an advance of perhaps 3d. to 4d. per ton on those of last year. For single cargoes of best Durham gas coals, the price is higher; but it varies considerably with different producers—about 7s. to 7s. 6d. per ton f.o.b. being the average quotation. There is no alteration in the price of gas coke this week; but the supplies are a little fuller.

Scotch Coal Trade.—During the past week work was not in full swing in the collieries; and the output was thus restricted. So many works being also on holiday, the demand was small. In the market, so far as could be ascertained, there seemed to be a feeling of hopefulness that matters would remain in a satisfactory state, even if they do not improve. The only cause for anxiety is the engineering trouble, which, if it is prolonged, will cause a shrinkage in the demand for coal. The prices quoted were: Main, 6s. 3d. to 6s. 6d. per ton f.o.b. Glasgow; ell, 7s. to 7s. 6d; and splint, 6s. 6d. to 7s. The shipments for the week amounted to 172,533 tons—a decrease of 10,595 tons on the preceding week, but an increase of 6552 tons over the corresponding week of last year. For the year to date, the shipments amounted to 4,132,211 tons—an increase on the same period last year of 135,061 tons.

Cromer Water-Works Company, Limited.—The annual general meeting of this Company was held at the office, Cromer, on the 14th inst.—Mr. W. G. Sandford in the chair. The Directors' report showed a revenue of £1990, and expenditure to the amount of £607, compared with £1804 and £554 in the previous year; being an increase of 10·3 per cent. The amount carried to the profit and loss account was £1382, which, added to last year's balance, made a total of £1464; leaving, after payment of interest on the debenture stock, a gross sum of £1239, and a net balance of £989. This they recommended should be dealt with as follows: Payment of a dividend of 5 per cent., free of income-tax, £708; placing to the reserve fund account, £200; carried forward to next year, £81. The quality and yield of water have continued satisfactory; and the estimated quantity raised (excluding that pumped to waste during the construction of additional adits under the supervision of Mr. J. K. Frost, the Manager) was 32,738,000 gallons, against 25,454,000 gallons the previous year—an increase of 7,284,000 gallons. The report was adopted. In acknowledging a vote of thanks to the Directors and officials, the Secretary (Mr. P. E. Hansell) said it was 22 years since the Company was originally started; and it had been one of the greatest blessings Cromer had ever had, for a good water supply was a necessity to the place.

Reduction in Price.—The Northfleet and Greenhithe Gas Company have reduced the price of gas to 3s. 7d. per 1000 cubic feet to private consumers, and the charge for public lighting by 3s. per lamp per annum.

Tottenham Water Supply.—Mr. H. H. Law, one of the Inspectors of the Local Government Board, held an inquiry at Tottenham last Tuesday in respect of the application of the District Council to borrow £1800 for the extension of water mains and hydrants. There was no opposition; it being stated that the works were rendered necessary by reason of the additional number of buildings in the district.

The Wessenden Water-Works of the Huddersfield Corporation.—The annual inspection by the Corporation of Huddersfield of the portion of their water-works lying in the Wessenden Valley, where two new reservoirs are being constructed, was commenced last Thursday. The members of the Council are divided into two batches by ballot, and make the visit on different dates. On the day named, the first party drove to the head of the Wessenden Valley, which is about 1200 feet above sea-level. The sites of the two reservoirs in course of construction were visited; and great progress was found to have been made. The catch ground area in the Wessenden Valley is 3500 acres. On the works in course of construction, 450 men are now employed, under the superintendence of Mr. J. E. Hughes. The whole of the reservoirs of the Corporation (inclusive of Blackmoorfoot, Deerhill, and Longwood) now contain 160 days' supply of water; and after the Butterley and Blakeley reservoirs are finished, the Corporation will, under ordinary conditions, and having regard to the compensation water to be provided, have a supply for 200 days. When all are full, however, the supply will be equal to the necessities of 328 days.

Seville Water-Works Company, Limited.—The annual meeting of this Company was held last Thursday. The report stated that the income had amounted to £29,808. After deducting working expenses, cost of laying services, debenture interest, and exchange differences, the net profit was £11,546, as compared with £11,902 last year. To this sum was added the unappropriated profit brought forward (£977); and after charging the expenses incurred in issuing £6000 "C" debentures, the contribution to the sinking fund of £656, and the half-year's dividend at the rate of 4 per cent. per annum, the sum standing to the credit of profit and loss account was £6375. The Directors recommended that a similar dividend be paid for the past half year, which would absorb £5422, and that £439 be added to the reserve fund. Moving the adoption of the report, the Chairman (Mr. David Evans) stated that the business had progressed very satisfactorily. The only unfortunate feature was that the exchange still continued to rise; and if it remained at the same rate, the Directors might have some difficulty next year in paying a similar dividend to that they recommend on the present occasion. But they thought it advisable to take the risk of next year's exchange not turning out better, rather than lower the dividend now. If it were not for the bad state of exchange, they would have been able to pay a dividend of certainly 5 per cent., and possibly 6 per cent. Their works were progressing; but they were not deriving from them the revenue they hoped to do, because they could only put on the water as far as the connections and pipes were laid. Mr. W. Blaber seconded the motion, which was adopted. The usual formal business concluded the proceedings.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 211).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	23—25	..	4 4 0
100,000	10	,,	7⅞	Do. 7 p. c.	17½—18½	..	4 1 1
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	106—108	..	4 12 8
200,000	10	27 May	7	Belgrano (B. Ayres), Limited	9¼—10	..	7 0 0
100,000	Stck.	29 June	3	Do. 5 p. c. Deb. Stk	103—106	..	4 14 4
200,000	5	27 May	6½	Bombay, Limited	6½—7	..	4 5 9
40,000	5	,,	6½	Do. New, £4 paid	5¼—5¾	..	4 10 7
380,000	Stck.	26 Feb.	12	Brentford Consolidated	298—303	..	3 19 2
240,000	,,	,,	9	Do. New	223—228	..	3 18 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	145—150	..	3 6 8
159,375	,,	11 June	4	Do. 4 p. c. Deb. Stock.	130—134	..	2 19 9
220,000	Stck.	26 Mar.	11½	Brighton & Hove Original	273—278	..	4 2 8
208,820	,,	,,	8½	Do. A Ord. Stk.	201—206	..	4 2 6
933,500	Stck.	26 Feb.	5	Bristol, 5 p.c. max.	130—135	..	3 14 1
420,000	20	26 Mar.	11¼	British	56—57	..	3 18 11
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	23—25	..	4 12 0
71,000	10	,,	8½	Do. 7 p. c.	18—20	..	4 5 0
500,000	10	28 Apl.	6	Buenos Ayres (New) Limited	10½—11½	+½	5 4 4
200,000	100	1 July	6	Do. 6 p. c. Deb.	100—102	..	5 17 8
150,000	20	15 July	8¼	Cagliari, Limited	30—32*	..	5 3 1
100,000	10	11 June	8	Cape Town & District, Ltd	16¼—17½	..	4 11 8
50,000	50	3 May	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	343—348	+1	3 17 6
165,000	,,	,,	10½	Do. New do.	257—262	..	4 0 1
165,000	,,	11 June	4⅜	Do. 4½ p. c. Deb. do.	155—158	..	2 16 11
800,000	Stck.	11 June	13	Continental Union, Limited.	253—258	+3	5 0 9
200,000	,,	,,	10	Do. 7 p. c. Pref.	212—217	..	4 12 2
51,600	Stck.	26 Feb.	14	Croydon Com'cial A 10 p. c.	317—322	..	4 6 11
163,400	,,	,,	11	Do. B 7 p. c.	255—260	..	4 4 7
535,000	Stck.	26 Feb.	5¼	Crystal Palace Ord. 5 p. c. Stk	139—142	..	3 13 11
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—143	..	3 9 11
486,090	10	29 Jan.	11	European, Limited	25—26	..	4 4 7
354,060	10	,,	11	Do. £7 10s. paid	18—19	..	4 6 11
5,896,590	Stck.	12 Feb.	12¾	Gaslight & Coke, A, Ordinary	313—318	−2	4 0 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	113—118	..	3 7 10
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	317—322	+2	3 2 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	150—155	..	3 4 6
63,000	,,	,,	7⅛	Do. G, 7⅛ p. c. do.	220—225	..	3 6 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207—212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	315—320	..	3 2 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	182—187	..	3 4 2
1,061,150	,,	11 June	4	Do. 4 p. c. Deb. Stk.	138—141	..	2 16 9
294,850	,,	,,	4⅜	Do. 4½ p. c. do.	155—158	..	2 16 11
908,000	,,	,,	6	Do. 6 p. c. do.	205—210	..	2 17 1
70,000	10	13 May	6	Hongkong & China, Limited	13½—14½	..	4 2 9
3,800,000	Stck.	13 May	10	Imperial Continental	224—229	+1	4 7 4
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100—103	..	3 17 8
473,600	Stck.	12 Feb.	3½	Do. 3½ p. c. Deb. Stk	104—107	..	3 5 5
75,000	5	29 June	6	Malta & Mediterranean, Ltd.	5½—6	..	5 0 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	112—114	..	4 7 8
250,000	100	,,	4½	Do. 4½ p. c. Debs.	107—109	..	4 2 7
541,920	20	11 June	5	Monte Video, Limited	14½—15½	..	6 9 0
150,000	5	27 May	8	Oriental, Limited	8¼—8⅝	..	4 11 5
135,000	5	,,	8	Do. New, £4 10s. paid	7½—7⅞	..	4 12 10
15,000	5	,,	8	Do. do. 1879, £1 paid	1¾—2	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	5—5¼	..	6 7 3
420,000	100	3 May	6	People's Gas } 1st Mtg. Bds.	104—109	..	5 10 1
500,000	100	1 June	6	of Chicago } 2nd Do.	105—110	..	5 9 1
250,000	10	27 May	10	San Paulo, Limited	14½—15½	..	6 9 0
5,475,000	Stck.	26 Feb.	5¼	South Metrop., 4 p.c. Ord.	145—148	+1	3 10 11
1,416,667	,,	15 July	3	Do. 3 p.c. Deb. Stk.	105—109*	..	2 15 0
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	275—285	..	4 0 10
60,000	,,	,,	8½	Do. B	190—200	..	4 5 0
182,380	10	27 May	10	Tuscan, Limited	13½—14½	..	6 18 0
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	100—103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	29 June	10½	Chelsea, Ordinary	334—338	+1½	3 2 1
150,000	,,	,,	5	Do. 5 p. c. Pref.	177—180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	157—160	..	2 16 3
175,785	,,	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160—165	..	2 14 6
1,720,560	Stck.	9 Apl.	7	East London, Ordinary	223—228	+1	3 1 4
654,740	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	163—166	..	2 14 3
390,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	106—108	..	2 15 7
700,000	50	11 June	7½	Grand Junction, 10 p.c. max.	120—125	..	3 0 0
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148—153	..	2 12 4
708,000	Stck.	12 Feb.	12	Kent	347—351	..	3 8 3
160,000	,,	,,	7	Do. New, 7 p. c. max.	212—217	..	3 4 6
1,043,800	100	29 June	9¾	Lambeth, 10 p. c. max.	285—290	+2	3 7 2
406,200	100	,,	7⅛	Do. 7⅛ p. c. max.	217—222	..	3 7 7
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147—150	..	2 13 4
500,000	100	12 Feb.	13	New River, New Shares.	437—442	+7	2 18 9
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	153—156	+1	2 11 3
902,300	Stck.	29 June	5	S'thwk & V'xhall, Ordinary	160—163	..	3 1 3
126,500	100	,,	5	Do. Do. 7½ p. c. Max.	150—153	..	3 5 4
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	173—178	..	2 16 2
1,019,585	,,	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145—148	..	2 14 2
1,155,066	Stck.	11 June	10	West Middlesex	312—317	..	3 3 1
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	162—167	..	2 13 11

*Ex div.

Windsor Water Supply.—A proposal is being considered by the Windsor Town Council for the erection of a reservoir at their water-works at Tangier Islands, Eton, with the view of obtaining a constant supply of water at all hours during the day and night. A large quantity of water is used on the roads in the morning; and if such a reservoir is constructed, the supply for domestic purposes will not be lessened.

New Joint-Stock Companies.—The Simplex Prepayment Meter Syndicate, Limited, has been registered with a capital of £5000, in £1 shares, to adopt a certain agreement, and to acquire, develop, and turn to account, any patents or rights connected with prepayment gas-meters. The Penny-in-the-Slot Electric Supply Syndicate, Limited, has been formed, with a capital of £50,000, in £1 shares, to adopt and carry into effect an agreement made between the Electric Lighting Extension Syndicate, Limited, and the Company, and generally to carry on, in the United Kingdom or elsewhere, the businesses of producers, storers, and suppliers of electricity.

The Proposed New Gas-Works at Padiham.—A special meeting of the Padiham District Council was held last Thursday for the purpose of considering the question of applying to the Local Government Board for power to borrow £26,000 for the construction of gas-works. Mr. G. Moorhouse, who moved a resolution to the effect that the application should be made, said it was unnecessary to re-open a discussion on the details of the scheme. Members of the Council were aware that the present gas-works were inadequate for the future requirements of the town. Mr. Steele, in seconding the motion, agreed that new works were necessary. Several members suggested that an undertaking should be given that the work should not be proceeded with for twelve months, as the financial position of the Corporation was not very good. Eventually the motion was carried unanimously, on the understanding that when the necessary powers are obtained the scheme will be further considered.

Blackburn Corporation Gas and Water Finances.—The annual abstract of the accounts of the Blackburn Corporation has just been issued by Mr. J. H. Bailey, the Borough Treasurer. Dealing with the Gas Department, the report says the total receipts for the year were £94,000; and after paying for maintenance and the interest on the sinking fund, £4200 was handed over to the reserve fund account. The working of the Water Department (after setting aside £4246 for the sinking fund and repayment of loans) showed a loss of £970, as compared with a net loss of £4279 in the previous year. This loss was transferred to the general district rate revenue account. The aggregate balance-sheet shows that the assets of the Corporation (including the gas, electricity, and water undertakings) amount to £2,854,913. The liabilities being £2,423,820, there is a surplus of £441,093, being an increase of £22,614 on the year. The total borrowing powers of the Corporation amount to £3,146,877, of which sum the following amounts have actually been raised: General district fund, £838,052; borough fund, £166,934; water-works, £928,164; gas-works, £748,693; and electric lighting, £32,000—making a total of £2,713,843. Of this sum, £364,062 has been repaid; leaving the net amount owing £2,349,781.

Automatic Gas-Meter (1895) Corporation.—At an extraordinary general meeting held on Friday at the Company's works, Manchester, Mr. H. J. Davis presiding, it was unanimously resolved to accept the offer made by a financial Syndicate for the purchase of the undertaking at a price equal to the called-up capital of the Company, *plus* a premium of 20 per cent., with a view to joining in a proposed amalgamation of gas-meter companies.

The Price of Gas in the Salford Out-Districts.—The efforts of the Worsley Union District Council to secure a larger concession in the price of gas than that proposed by the Salford Gas Committee, by opposing the Salford Corporation Bill, have proved successful. The Council have obtained a reduction from 2s. 11d. to 2s. 6d. The differential rate, which has been abolished in the Eccles, Swinton, and Pendlebury districts, will in future only be 2d. in the Worsley Council's area; and if the Salford Corporation reduce their own price, there is to be a simultaneous reduction in Walkden and Worsley in the same proportion. With the discount, the price now will only be 2s. 4d. per 1000 cubic feet – a reduction of 5d.

The New Staines Reservoirs Stock.—Last Wednesday, the tenders recently invited in our advertisement columns, by the Staines Reservoirs Joint Committee, for £250,000 of 3 per cent. debenture stock, were opened. All tenders at and above the reserve were allotted in full; and the average price for the accepted tenders was £103 16s. 9d. per cent. The total amount of stock applied for was £369,700—nearly 50 per cent. more than was offered. The stock, it may be remembered, is the first portion of that created by the Act under which the Committee were incorporated (59 and 60 Vict., cap. 241); and the payment of the interest is guaranteed by the three Water Companies represented upon the Committee—viz., the West Middlesex, Grand Junction, and New River. It is redeemable after 25 years from the date of issue, subject to six months' notice by the Committee.

Hoylake and West Kirby Gas and Water Company, Limited.—At the annual meeting of this Company on Friday next, the Directors will report that £2208 will be available for distribution among the shareholders as the result of the working in the year ending June 30. Of this total, £952 is referable to the gas, and £1256 to the water portion of the undertaking. Dividends of 6½ per cent. on the original, and 4·7 and 7½ per cent. on the additional gas capital, and at various rates on the water capital, will be recommended—making with the interim payments 10½ and 7½ per cent. on the former, and 8¾ and 6½ per cent. on the latter capital. After payment of these, there will be about £52 to be carried forward. The total receipts amounted to £9448; the expenditure, to £5525—leaving a balance of £3923. In the manufacture of gas, 2077 tons of coal and cannel and 20,105 gallons of enriching oil were used; and 21,879,050 cubic feet of gas were sold for public and private lighting—326,780 cubic feet by prepayment meters. The Company have come to an end of their capital; and they have therefore applied for power to raise more. A Provisional Order authorizing an increase of £9000 has been granted by the Board of Trade; and, as mentioned in the "JOURNAL" last week, it is included in one of the Confirmation Bills now.

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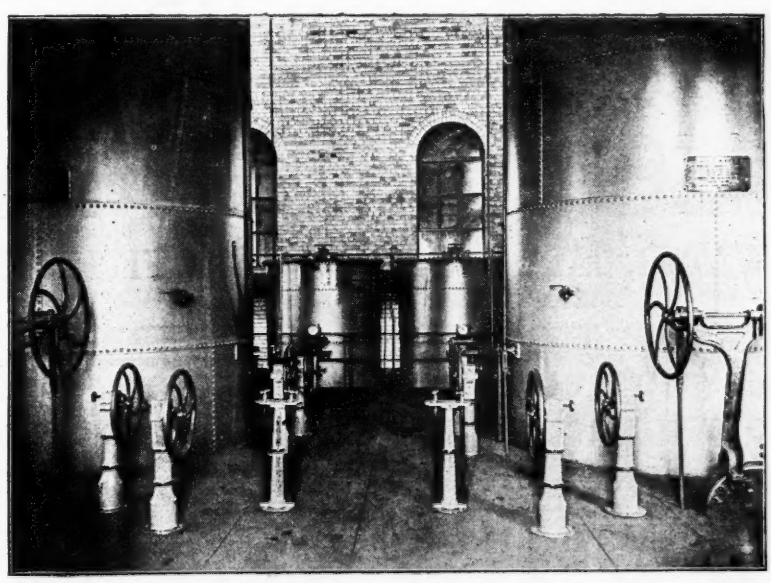

RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.

Sales of Shares.—At a recent sale at Westhoughton, seven £10 shares in the Westhoughton Gas Company changed hands at £13 2s. each. At Reigate, last Wednesday, 67 £5 shares, fully paid, in the Redhill Gas Company realized by public auction £11 15s., £11 12s. 6d., and £11 10s. each.

Llandudno Gas and Water Supply.—The annual accounts of the gas and water works were submitted at the meeting of the Llandudno District Council last Wednesday. The gas undertaking showed a profit of £1358; and the Committee recommended that, instead of reducing the price of gas, the charge for the hire of meters be abolished. The water department showed a loss of £199, as compared with £658 last year; and the amount received from outside districts was £456 less than in 1895-6. The Engineer presented an amended estimate for carrying out the first portion of the scheme for the extension of the water-mains, amounting to £8634; and the Clerk was instructed to apply for power to borrow the money required. The reports were adopted.

Colne Valley Water Company.—The accounts of this Company for the half year ending June 30, which will be presented to the proprietors at their meeting on the 3rd prox., show that a sum of £10,638 was expended in that period on capital account; nearly £8000 being in connection with the new engine and buildings at the pumping station, and the remainder for pipe extensions, including a 6-inch main to Letchmore Heath. The new works at the pumping-station are almost completed. The profit on revenue account is £5444; and the total amount available for division, after payment of the interest on the debenture stock and the preference shares, and the transfer of £250 to the old engines suspense account and £100 to the reserve account, is £4077. This will allow of a dividend at the rate of 4½ per cent. per annum, and leave £491 to carry forward.

The Purchase of the Chichester Water-Works by the Corporation.—The proceedings in connection with the purchase of the Chichester Water-Works by the Corporation were advanced another stage on Thursday, when the Finance Committee presented an estimate as to the amount of stock required to be issued to pay for the undertaking, as follows: Purchase-money, at £23 per share, £46,000; for improvements and extensions, £5000; and other items brought the total up to £54,597. The Committee recommended the Council to apply to the Local Government Board for sanction to create further stock, by way of addition to the Corporation 3 per cent. redeemable stock or otherwise, to the amount of £55,000. After some discussion, in the course of which Mr. Mant pointed out that the income from the works would only return 2½ per cent. on the amount proposed to be raised, the recommendation was agreed to.

The Directors of the Gas, Water, and General Investment Trust, Limited, have resolved to pay an interim dividend at the rate of 4½ per cent. per annum on the preferred stock for the half year ended July 28.

An exhibition of gas appliances manufactured by Messrs. Fletcher, Russell, and Co., Limited, was held in the Victoria Hall, Huddersfield, from the 13th to the 16th inst.; cookery lectures being given by Mrs. H. M. Young.

In conjunction with the Castle Donington Gas Company, the Davis Gas-Stove Company held an exhibition of gas appliances in the town last week. Cookery demonstrations by Mrs. Springthorpe attracted good audiences.

For five days last week, Messrs. Richmond and Co., Limited, were exhibiting specimens of their gas-stoves and other appliances in the Lecture Hall, Ipswich. The practical use of gas cooking-ranges was demonstrated by Miss Annie Stansfield.

The Metropolitan Asylums Board have placed with Messrs. Willey and Co., of Exeter, a contract for the enlargement of their gasholders and mains at the Darenth Asylum gas-works, in accordance with a specification prepared by Mr. F. Livesey, M.Inst.C.E.

The Daventry District Council having received seventeen schemes of water supply for Long Buckby, selected four for submission to Mr. J. Eunson, Assoc.M.Inst.C.E., of Northampton, who advised the acceptance of the project of Messrs. Usill, Browne, and Usill as being the best and most practicable.

The Mitcham and Wimbledon Gas Company have decided to erect a bench of eight ovens, in settings of eights, upon Mr. G. R. Hislop's patent regenerative system. An additional bench of 48 retorts, on the same plan, is to be erected at Kidderminster; and the system has also been extended at Waltham Cross, Mountain Ash, and other places.

Under the auspices of the Ardrossan Commissioners, an exhibition of the "Hercules" gas kitcheners of the "Cannon" Hollow-Ware Company, Limited, was held in the Town Hall from the 13th to the 16th inst. These cookers are exclusively adopted by the Commissioners; and their capabilities were fully demonstrated by Miss Lewis in a series of interesting lectures.

Price 7s. 6d. per 100; £3 *per* 1000 (*Carriage Free*), *Demy 4to.*,

A LEAFLET ON

SULPHATE OF AMMONIA:

ITS SOURCE—RELATIONSHIP TO SOIL—EFFECT ON PLANTS.

BY

H. H. COUSINS, M.A., South-Eastern Agricultural College, Wye.

London: WALTER KING, 11, Bolt Court, Fleet St., E.C.

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They have completed Exhausters to the extant of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

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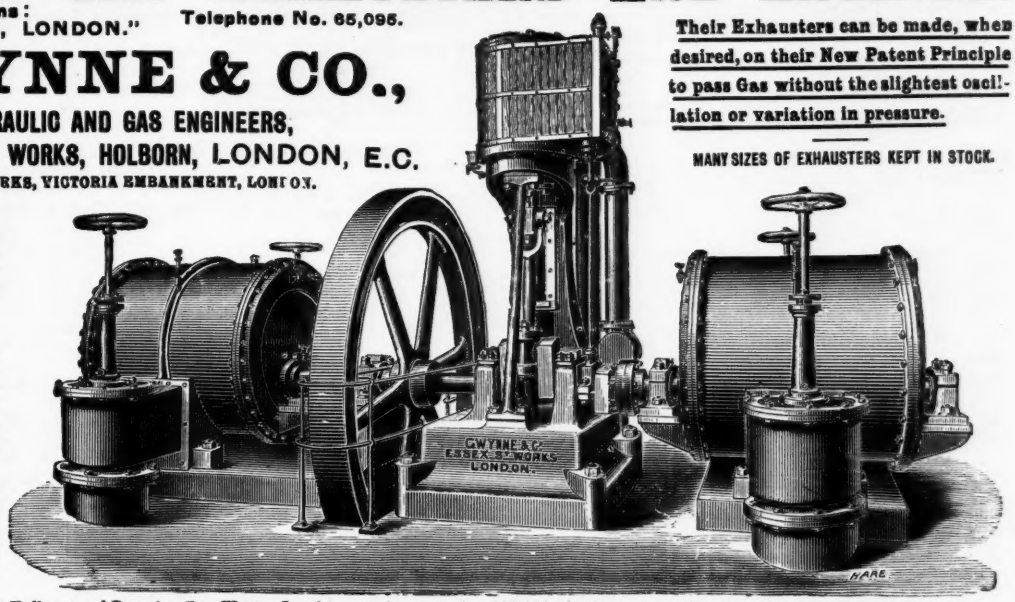

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Catalogues and Testimonials sent on application.

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NOTICE TO ADVERTISERS.—In consequence of the BANK HOLIDAY, orders with respect to ADVERTISEMENTS shou'd be received at the Office *not later* than THE FIRST POST ON SATURDAY NEXT.

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TUBES for Gas, Steam, and Water (all Sizes), Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.
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Telegrams: "HUTCHINSON BROS., BARNSLEY."

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First-Class Award, Melbourne Exhibition, 1899, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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[For Illustrated Advertisement, see July 6, p. 68.]

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The Salary will be £700 a year.
The Person appointed will be required to give his whole time to the duties of his office.
Forms on which application is to be made and further Particulars can be obtained from the Clerk, London County Council, Spring Gardens, S.W.
The latest time for receiving applications is Ten o'clock a.m., on Saturday, the 11th of September.
Any form of application which is not filled up, or which in any respect fails to comply with the terms of the advertisement, will not be laid before the Council.
Personal canvassing is strictly prohibited.
C. J. STEWART,
Clerk of the Council.
County Hall, Spring Gardens,
July 23, 1897.

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None but those who have occupied a senior position in a Gas Company's Office need apply.
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Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

FOR SALE—A Station Meter complete, in thorough working order. Recently overhauled and certified correct by Messrs. Braddock. Capacity, 50,000 feet per hour.
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For further Particulars, apply to
JAS. BRODIE,
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Gas-Works, Kilmalcolm, N.B.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

URBAN DISTRICT OF MILFORD HAVEN.

TENDERS FOR GAS COAL.

THE Milford Haven Urban District Council are prepared to receive TENDERS for about 600 Tons of GAS COAL, including CANNEL, Large and Through, and also about 70 Tons of Bituminous STEAM COAL, to be delivered between the 1st of September, 1897, and the 1st of September, 1898. The whole of the Coal to be Fresh Hewn, Clean, and free from Impurities.
Further Particulars and Forms of Tender can be obtained on application to the undersigned.
Sealed tenders, endorsed "Tender for Coal," addressed to the Chairman, Gas and Water Committee, to be sent in not later than the 11th of August next.
The Council do not bind themselves to accept the lowest or any tender.
By order,
THOMAS H. LEWIS,
Clerk.
Milford Haven, July 24, 1897.

UXBRIDGE AND HILLINGDON GAS CONSUMERS' COMPANY.

TAR.

THE Directors are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works during the ensuing Twelve Months from the 1st of September next.
The quantity of Tar will be about 35,000 gallons, and will be delivered free into Contractors' Barges alongside the Works, on the Grand Junction Canal.
Tenders, endorsed "For Tar," must be addressed to the Chairman, and be delivered at the Company's Offices, Uxbridge, not later than Saturday Evening, Aug. 7.
The Company have no special Form of Tender; but it is suggested that the Tar should be tendered for at so much per gallon.
The Directors do not bind themselves to accept the highest or any tender.
Further Particulars may be obtained of the undersigned.
W. M. GARDINER,
Secretary.
Uxbridge, Middlesex,
July 20, 1897.

OSWALDTWISTLE URBAN DISTRICT COUNCIL.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at their Works for One Year from the 31st day of July, 1897.
The quantity of Coal carbonized is about 3500 Tons.
Further Particulars may be obtained from the Manager, Gas-Works, Church, near Accrington.
Tenders, endorsed "Tender for Tar," to be addressed to me, and to be delivered not later than Thursday, the 29th of July.
WM. SANDEMAN,
Clerk.
District Council Offices,
Oswaldtwistle, July 16, 1897.

LEIGH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Gas Committee of the above Council invite TENDERS for the purchase of the surplus TAR produced at their Works for a period of One Year, from the 1st of September next.
All Particulars with Form of Tender may be obtained from the Manager, Mr. John Foster, Gas-Works, Leigh.
Sealed tenders, endorsed "Tender for Tar," to be addressed to me the undersigned at or before Twelve o'clock noon, on Monday, Aug. 16, 1897.
By order,
G. DICKINSON,
Clerk to the District Council.
Town Hall, Leigh, Lancs.,
July 23, 1897.

MOSSLEY CORPORATION GAS-WORKS.

TENDERS FOR COAL AND CANNEL.

THE Gas Committee of the above Cor- poration invite TENDERS for the supply of 9000 Tons of GAS COAL and 1000 Tons of CANNEL, for delivery over the Year ending Sept. 30, 1898.
Specification and Form of Tender may be obtained from the Manager (Mr. R. Merrell) at the Gas-Works.
Sealed tenders, endorsed "Tender for Coal and Cannel," to be sent to the undersigned not later than Saturday, Aug. 7 next.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
JOSEPH HYDE,
Town Clerk.

GAS COAL.

THE Directors of the Newark Gas Com- pany are prepared to receive TENDERS for the supply of 6000 Tons of best screened SOUTH YORKSHIRE GAS COAL, delivered at Newark (G.N.R.), in such quantities as may be required, during the ensuing Year from Sept. 1 next.
The Coal to be fresh wrought, free from Dirt, Bats, Shale, Pyrites, and other Impurities.
The Company reserve the right to divide the above amount.
Tenders, marked on the outside "Tender for Coal," to be sent in to me on or before Aug. 4, 1897.
For further Particulars, apply to
F. B. FOOTTIT,
Secretary.
Newark, July 19, 1897.

SPALDING GAS-WORKS.

THE Spalding Urban District Council invite TENDERS for the supply of 2000 Tons of the best NEWCASTLE GAS COAL or any larger quantity that may be required not exceeding 3000 Tons and 500 Tons of the best Screened SILKSTONE GAS COAL or NUTS, to be delivered in such quantities as shall be from time to time required and ordered by them or by their direction up to the 30th day of June, 1898.
Sealed tenders, to be endorsed "Tender for Coals," stating the price per Ton delivered f.o.b. in the Tyne or at the Spalding Gas-Works, to be sent to the undersigned at the Office of the Council, 8, Double Street, Spalding, on or before the 14th day of August next.
N.B.—The Council do not supply Forms of Tender.
The Council do not bind themselves to accept the lowest or any tender.
H. H. HARVEY,
Clerk to the Council.
Spalding, July 24, 1897.

BANDON TOWN COMMISSIONERS (CO. CORK).

TENDERS FOR GAS COAL.

THE Commissioners are prepared to receive TENDERS for the supply of 1000 Tons of best GAS COAL, delivered at Albert Quay, Cork, in such quantities as may be required, from date of acceptance of Tender to the first week in December, 1897.
No Tender Forms issued.
Tenders, stating price per ton (20 Cwt.), delivered as above, to be sent to the undersigned, and marked "Tender for Coal," not later than the 31st inst. (Noon).
The Commissioners reserve the right to accept tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.
By order,
JOHN M'DONNELL,
Town Clerk.
Board-Room, Gas-Works,
Bandon, July 20, 1897.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices of the Company, No. 63, Chancery Lane, in the County of Middlesex, on Friday, the 13th day of August, 1897, at 3.30 o'clock in the afternoon precisely, to receive a Report from the Directors, declare Dividends, and transact the Ordinary Business of a General Meeting.
The TRANSFER BOOKS WILL BE CLOSED on the 30th of July until after the General Meeting.
By order of the Board,
S. J. WILLIAMS,
Secretary.
63, Chancery Lane, W.C.,
July 22, 1897.

BROMLEY GAS CONSUMERS' COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the Bell Hotel, Bromley, Kent, on Thursday, the 12th day of August, at Six o'clock p.m. precisely, to receive the Report of the Directors, the Balance-Sheet certified by the Auditors, to declare Dividends, and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from the 27th of July to the 12th of August, 1897, both days inclusive.

By order of the Board,
HENRY W. AMOS,
Secretary.

Offices at the Works, Bromley, Kent,
July 26, 1897.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors in this Company, will be held at this Office on Friday, the 6th day of August next, at Twelve o'clock (noon) precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending on the 30th day of June last.

Notice is Hereby also Given, that at such Meeting the Directors will apply to the Proprietors for Authority, in pursuance of the powers of the Company's Act of 1876, TO RAISE from time to time ADDITIONAL CAPITAL by the creation and issue of a Sum not exceeding £150,000 of new Ordinary "A" Consolidated Stock; also to raise from time to time further money by the creation and issue of a Sum not exceeding £175,000 Debenture Stock.

Notice is Hereby further Given, that at such Meeting the Directors will apply to the Proprietors for AUTHORITY TO DISPOSE of such FURTHER PORTIONS of the COMPANY'S PROPERTY as are not now required for the purposes of their Undertaking.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., July 20, 1897.

By Order of the Directors of
THE GASLIGHT AND COKE COMPANY.

ISSUE OF £25,000 "A" ORDINARY STOCK.

MR. ALFRED RICHARDS is favoured with Instructions from the Directors to SELL BY AUCTION, at the Mart, Tokenhouse Yard, London, E.C., on Monday, Aug. 9, 1897, at One for Two o'clock precisely, in Lots,

£25,000 OF "A" ORDINARY STOCK
OF
THE GASLIGHT AND COKE COMPANY,

ranking for a Standard Dividend of 10 per cent. subject to the Sliding-Scale; the last Dividend on the Company's "A" Stock having been at the rate of
12¾ PER CENT. PER ANNUM.

Particulars may be obtained at the OFFICES of the COMPANY, in Horseferry Road, WESTMINSTER; and of Mr. ALFRED RICHARDS, Auctioneer, 18, FINSBURY CIRCUS, E.C.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Power.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.

TO TRUSTEES, INVESTORS, AND OTHERS.

NOTICE of Sale by Auction by Messrs. CRAWTER, at the Mart, Tokenhouse Yard, E.C., on Wednesday, Aug. 11, 1897, at Two o'clock precisely, of 625 SHARES of £10 each in the WALTHAM ABBEY AND CHESHUNT GAS AND COKE COMPANY, and known as "C" Shares, which, according to the present Price of the Company's Gas, entitles the Purchasers to a Dividend, when earned, of 10½ per cent.; thus offering a sound Investment of the most solid kind.

Particulars may be obtained at the OFFICES of the Company, Waltham Abbey, Essex; at the Mart; of Mr. J. CRAWTER, Land Agent, 41, BEDFORD ROW, W.C.; or of Messrs. CRAWTER, Land Agents and Auctioneers, Cheshunt, HERTS.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS.

By N. H. HUMPHRYS, Assoc M.Inst.C.E., F.C.S.

LONDON:
WALTER KING, 11, Bolt Court, Fleet Street, E.C.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, MINER AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

5, PRINCES STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

E. ASQUITH & CO.,

Hydraulic Engineers,

17, Mather Street, Ancoats, Manchester,

Fit up Plants for

Pressing Anthracene, Naphthalene, &c.

Competent Men sent out to erect same. Estimates given.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
B Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.,
And at STROUD, GLOUCESTERSHIRE.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton. . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton. . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON NEWCASTLE.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:
90, CANNON STREET, E.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

London Office: R. Cull, 84, Old Broad St., E.C

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

Lanemark Coal Co.,
LIMITED.

LANEMARK CANNEL AND GAS COALS.

Quotations and Analysis on Application to

LANEMARK COLLIERY,
NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

WATERBLEAN PAINT

Telegrams:
"EVESON, BIRMINGHAM."

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, near DEWSBURY.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

ROBERT MARSHALL,
CANNEL COAL MERCHANT
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

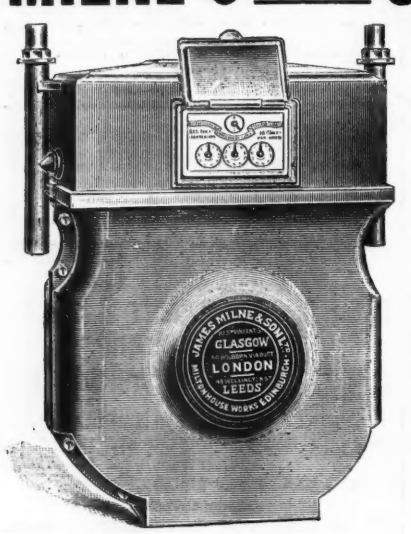
SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
Coal Owners, Newcastle-on-Tyne;
or
E. FOSTER & CO.,
21, John Street, Adelphi, London, W.C.

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND,
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

MILNE'S PATENT COMPOSITE DRY GAS-METER



THE WORKING PARTS OF A TIN-CASE DRY METER ENCLOSED IN A TWO-PART IRON-CASE.

THIS Meter combines all the advantages of the Dry Gas-Meter with the strength and durability of the Wet Meter. It consists of Cast-Iron Cases front and back enclosing the bellows, and screwed to each other with the Division-Plate between; while the upper portion containing the Valve Chambers and Index is made of extra thick Tinned Iron—the Side Tubes being made of brass, with suitable provision for Trapping any Condensation.

It is well known that the only parts of an ordinary Tin-Case Dry Meter which are attacked by outside Corrosion are the bottom and the lower parts of the Sides, and also the Side Tubes. In this Composite Meter, these parts are made either of Cast Iron or Brass, and thus rapid deterioration is prevented, and the weight is not unduly increased.

JAMES MILNE & SON, LTD.,
GAS ENGINEERS, Milton House Works, EDINBURGH,
LONDON. GLASGOW. LEEDS.

JOHN BROWN & CO., LTD., SHEFFIELD.

Proprietors of

ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

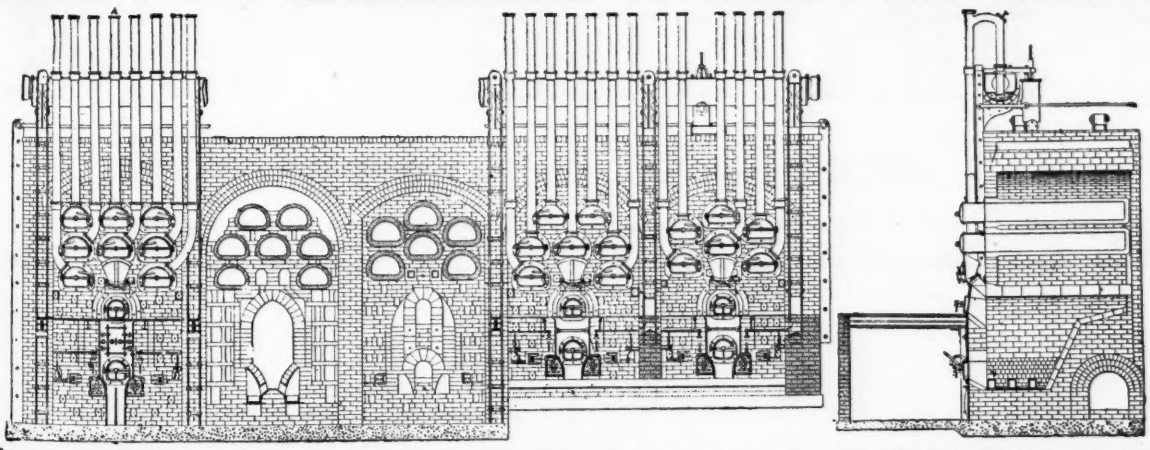
VERY FREE FROM IMPURITIES.

TELEGRAMS: "ATLAS, SHEFFIELD."

W. J. JENKINS & CO., RETFORD.

COAL UNLOADING AND CONVEYING MACHINERY.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 17 TO 20 CWT. OF ENGLISH AND 20 TO 24 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, Hamilton, Agent for Scotland and Ireland; Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B., and to whom all Inquiries should be addressed in the first instance.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S Patents, all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.

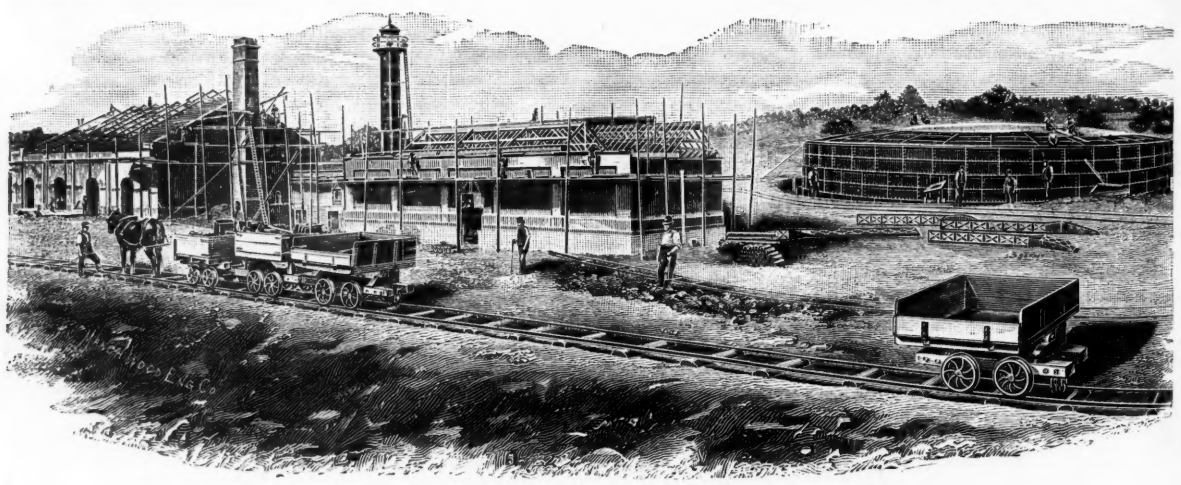
Further Information and Pamphlets from Principal Agent.

Wrought-Iron
TUBES
And Fittings and Accessories.

LAMBERT BROS., WALSALL,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., Ltd., Short St., LAMBETH.

LONDON OFFICE
60, QUEEN VICTORIA ST. E.C.
TELEGRAPHIC ADDRESSES
"DRAKESON HALIFAX."
"ECLAIRAGE LONDON."
TELEPHONE No 43.
"HALIFAX EXCHANGE"
GAS ENGINEERS.
CONTRACTORS.
IRONFOUNDERS.
RETORT SETTERS.
FURNACE BUILDERS.
ETC. ETC.
JONAS DRAKE & SON
SOLE AGENTS FOR
HISLOP'S
PATENT REGENERATIVE FURNACES
FOR
ENGLAND, WALES & ABROAD.
RETORT BENCHES ERECTED COMPLETE
WITH OR WITHOUT SPECIAL FURNACES.
RESULTS GUARANTEED.
OVENDEN HALIFAX
Designs and Estimates on Application.
GASEOUS FIRING A SPECIALTY.

R. DEMPSTER & SONS,
LIMITED,
GAS ENGINEERS and CONTRACTORS,
ELLAND, YORKS.
ESTABLISHED 1855. Telegrams: "DEMPSTER, ELLAND."



Engraved from Photograph of Complete Gas-Works in course of Construction.

The WHOLE of the Apparatus, Foundations, Retort Work, Buildings, and Levelling of Site have been executed by our own Workmen. No Sub-Contracts.

Estimates and Illustrations for complete Works, or for any detailed parts, supplied gratis on application.
Tenders given for all kinds of Structural Ironwork.

THE "TRAFALGAR"
PREPAYMENT GAS-METER
FOR PENCE, SHILLINGS, OR ANY COINAGE.

THE ADVANTAGES OF THIS SYSTEM ARE:

1. Simplicity of Mechanism.
2. Absolute Accuracy.
3. Impossibility of being tampered with.
4. Unaffected by irregularities in shape or thickness of the penny.
5. Can be fixed to any ordinary Wet or Dry Meter.
6. Extra large Money-Box.
7. Price Changer can be altered without otherwise disturbing the Meter.
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9. Rejection of half-pennies certain.

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DESIGNS AND ESTIMATES ON APPLICATION.

SUNLIGHT INCANDESCENT GAS-BURNERS.

IN CONSEQUENCE OF MISREPRESENTATIONS WHICH HAVE BEEN CIRCULATED RESPECTING THE SUNLIGHT MANTLES, THE FOLLOWING CERTIFICATE IS NOW GIVEN WITH EVERY MANTLE:—

"*The New Incandescent (Sunlight Patent) Gas Lighting Company, Limited, hereby certify that the within Mantle is in every respect similar in process of Manufacture and constituent parts or substances to the Mantle which was held by the Hon. Mr. Justice Wills* NOT TO BE AN INFRINGEMENT OF THE WELSBACH PATENTS."

AND WE FURTHER CALL ATTENTION TO THE EXTRACTS FROM THE JUDGMENT GIVEN BY THE HON. MR. JUSTICE WILLS, WHEN HE DISMISSED THE WELSBACH COMPANY'S APPLICATION FOR INJUNCTION:—

"No use is made by the Sunlight Company of any of the rare earths; and their choice of substances, and their method of applying the illuminants, appear to me to be **as wide asunder as the Poles** from those contemplated by Welsbach."

"Welsbach Company's Counsel, both admit that they have no case unless the Welsbach skeleton, of whatever resistant earth oxides composed, is within the Welsbach Patent. It seems to me that **this is just what Welsbach did not claim.**"

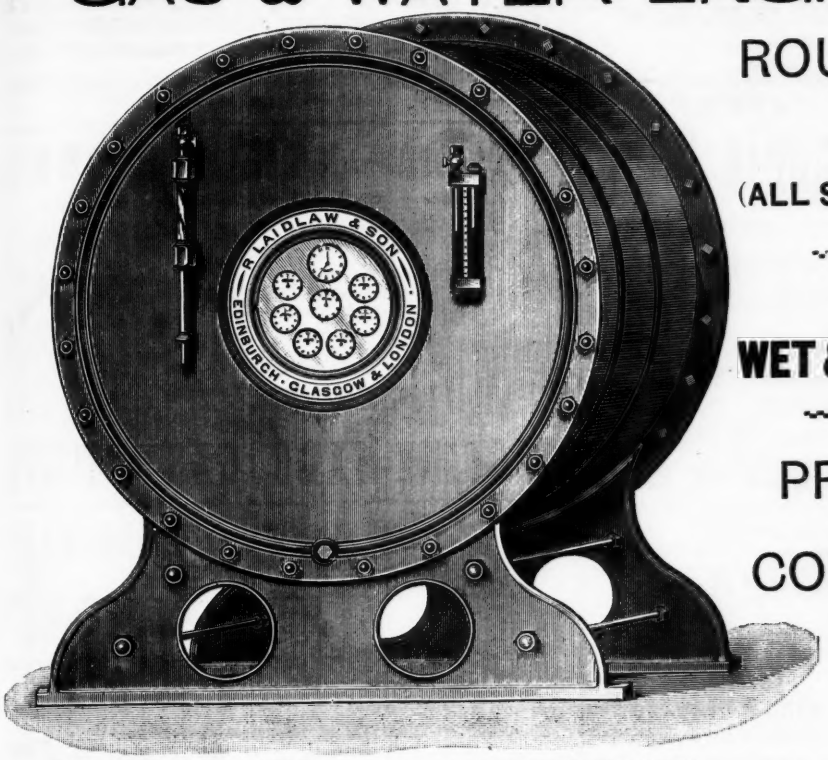
PRICE LIST AND TERMS ON APPLICATION.

THE NEW INCANDESCENT (SUNLIGHT PATENT) GAS LIGHTING Co., LIMITED.

33 & 34, Shoe Lane, London, E.C.

R. LAIDLAW & SON

GAS & WATER ENGINEERS.



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COMPENSATING
METERS.

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BARCELONA (Spain)
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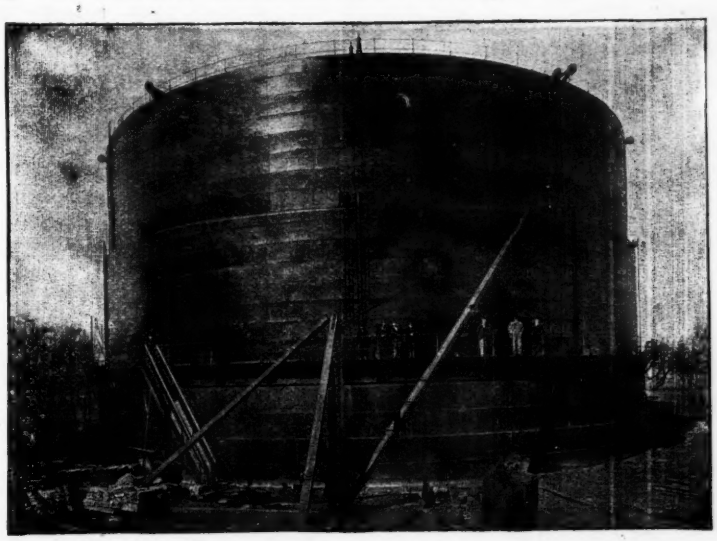
And many other places.



TWO-LIFT GASHOLDER. Capacity, 560,000 cub. ft. Steel Tank, 126 ft. 6 in. dia.; 25 ft. deep.
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FOR
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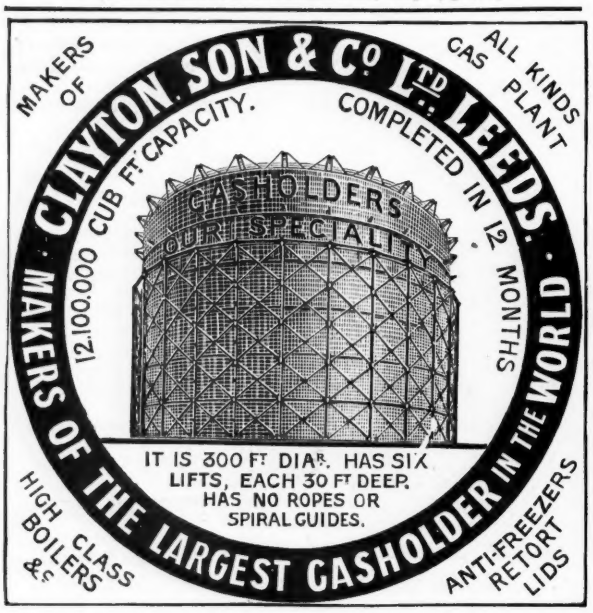
Full Particulars may be obtained from the Sole Makers,
SIR WILLIAM ARROL & CO., Limited,
GLASGOW.
[See Illustrated Advertisement, July 6, p. 70.]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IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
1. Smooth interior, preventing adhesion of Carbon.
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MACHINE-MADE GAS-RETORTS.

The Climax of Regenerative Gas Lighting!!

THE
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A 280-Candle Power
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CLASS A— 55/-
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less than half the price of any other Regenerative Lamp.
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PARTICULARS AND PRICES FREE. AGENTS WANTED.

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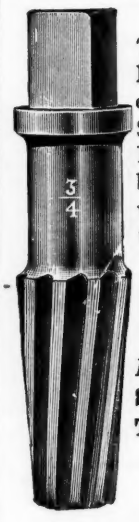

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Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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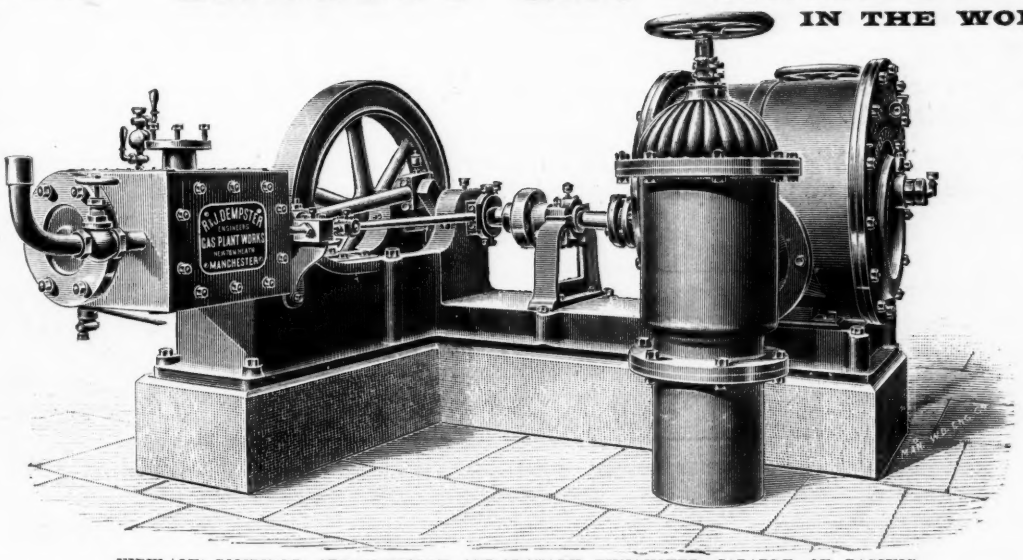

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Telegraphic Address: "INDEX."

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Telegraphic Address: "GAS-METERS."

[See also Advt. p. 206.

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